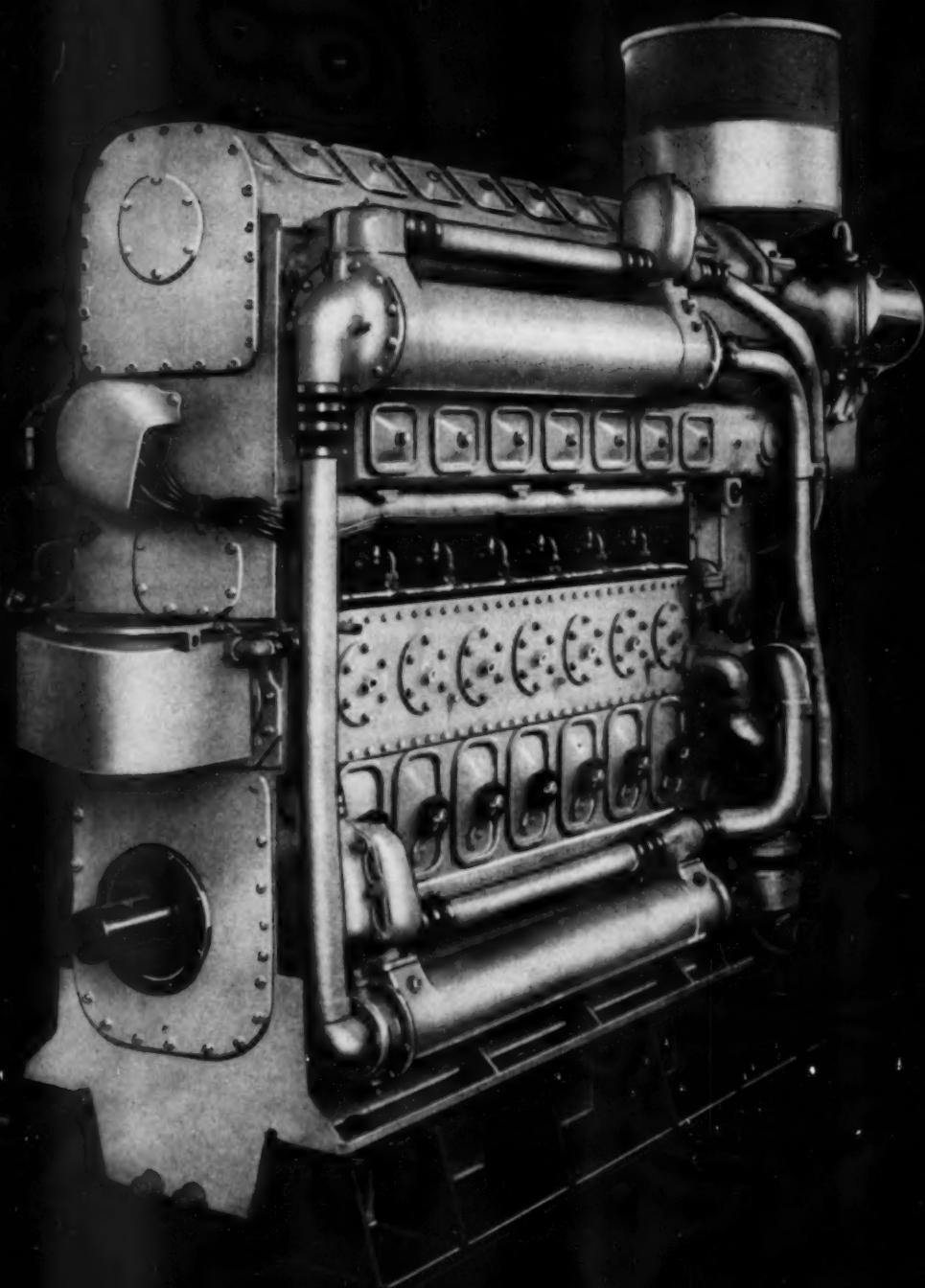


IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

DIESEL
PROGRESS



FIVE DOLLARS PER YEAR

MAY, 1953

FIFTY CENTS PER COPY

...SO MUCH BETTER LUBRICATION WITH

The Marshall (Michigan) Water and Electric Company started using *Texaco Ursa Oil* in two 5-cylinder Diesel engines in 1947. Results were so satisfactory — but read the story in the user's own words:

"We got so much better lubrication with *Texaco Ursa Oil* — lower maintenance costs and fuel economy — that when we installed a new 6-cylinder Diesel in 1948, we naturally chose *Texaco Ursa Oil* to lubricate it. Same with the 11-cylinder radial Diesel we installed in 1951. As new Diesels go into our plant, you can be sure *Texaco Ursa Oil* is going in with them."

The Marshall Water and Electric Company's experience with *Texaco Ursa Oil* is typical. *Texaco Ursa Oil* is made for lubrication of Diesel, gas and dual-fuel engines. It stands up under toughest operating conditions . . . keeps rings free for proper compression and combustion, lower fuel consumption and lower maintenance costs. That is why —

For over 15 years, more stationary Diesel h.p. in the U.S. has been lubricated with Texaco than with any other brand.

There is a complete line of *Texaco Ursa Oils*, approved by leading engine builders. A Texaco Lubrication Engineer will gladly help you select the proper one for your operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

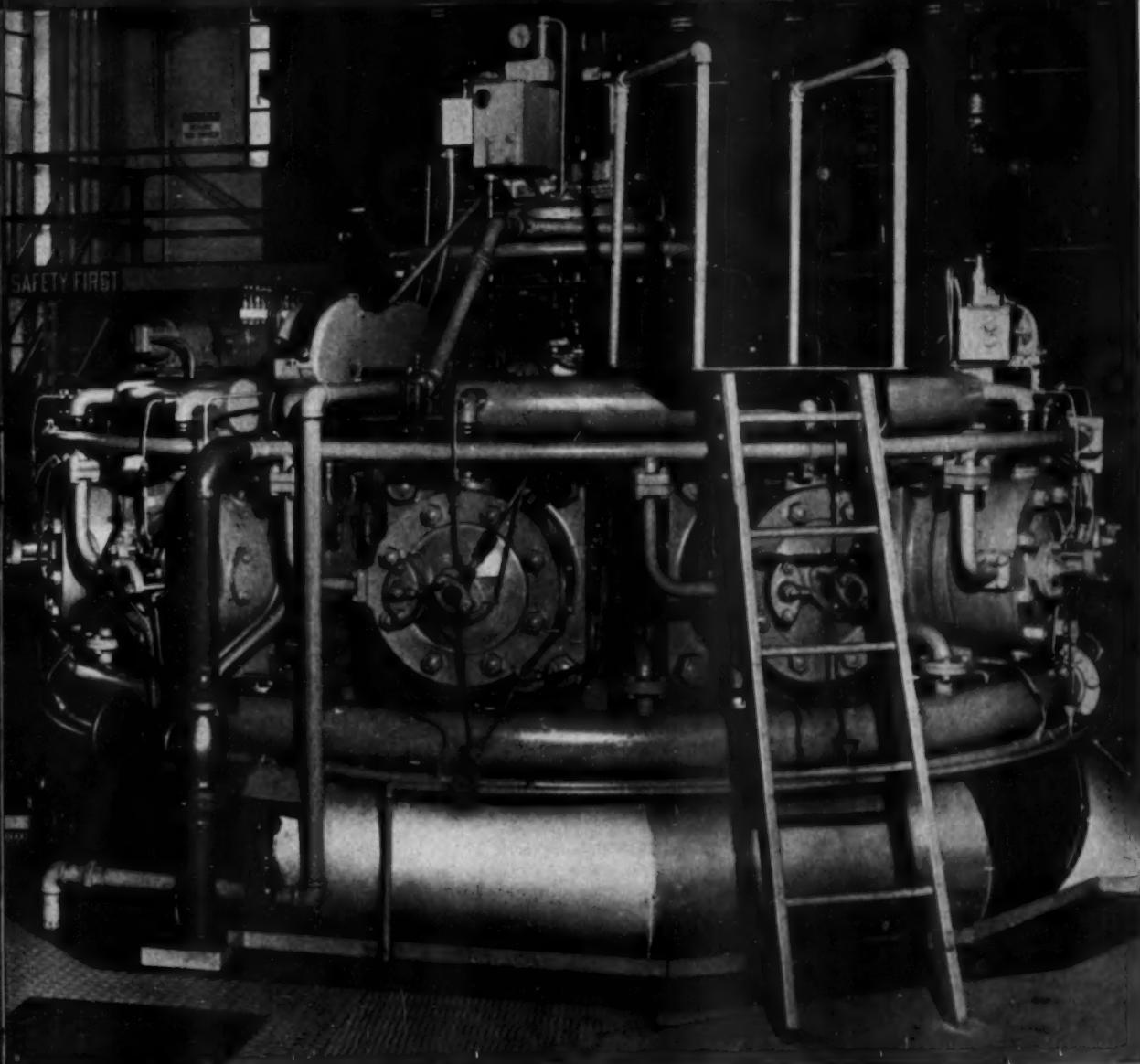
TUNE IN:
Tuesday nights
on television —
the TEXACO STAR THEATER
starring MILTON BERLE.

See newspaper for
time and station.



TEXACO

TEXACO URSA OIL™



URSA OILS FOR ALL DIESEL, GAS
AND DUAL-FUEL ENGINES

Allison Torqmatic Drives



The Team that stretches time between overhauls!

Operators of heavy-duty, off-highway trucks soon find in their cost records that Allison TORQMATIC Converters and TORQMATIC Transmissions extend time between overhauls and help cut repair bills amazingly.

Allison TORQMATIC DRIVES match the engine power to the loads. Maximum engine horsepower can be utilized throughout the entire haul cycle, thus eliminating harmful shocks, luging and stalling.

TORQMATIC DRIVES also cut operating costs

because they take out much of the human element in driving the vehicles—gearshift guess and gearbox clash are things of the past. Allison TORQMATIC DRIVES “quick shift” hydraulically at full throttle by a flick of a simple control lever.

Send for the Allison pamphlet completely describing these Drives and learn more about their broad application to heavy-duty equipment.

ALLISON DIVISION OF GENERAL MOTORS
Box 894DD, Indianapolis 6, Indiana

MATCHED UNITS BUILT BY ONE MANUFACTURER



If you've never used this—



maybe you should
It's UNIFLEX...

The new Helically-corrugated Seamless Flexible Tube

If you have a process or application involving flexible metal hose, it will pay you to know a few facts about UNIFLEX. For this entirely new, *seamless* flexible tubing is just coming into its own—in applications too critical for ordinary concentric tubing.

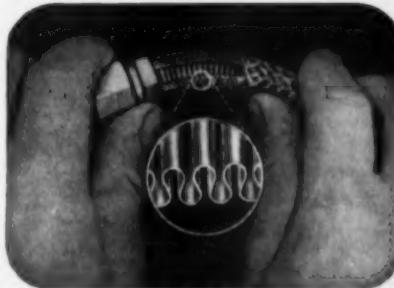
Consider . . .

1. We make UNIFLEX from *seamless*, special bronze alloy tube—tough, corrosion-resistant, leak-proof.
2. Helical corrugations give UNIFLEX greater flexibility and longer life. Our unique method of manufacture eliminates embrittlement resulting from excessive work-hardening.
3. For leakless service, UNIFLEX fittings have metal-to-metal seat. Seal is produced through spring washer effect of hose on fitting body.
4. Unlike conventional split-ring collars used on concentric tubing, the *one-piece* UNIFLEX collar hugs 4 or 5 convolutions. This means far less wear—and much greater strength in the connection.
5. UNIFLEX is encased in high-tensile bronze wire braid attached to specially designed couplings. Hose is relieved of damaging strains; sheath prevents elongation, gives extra safety, withstands abrasion.
6. UNIFLEX helical construction distributes flexing between inner and outer surfaces of convolutions—eliminates strain usually limited to one groove. Result: Greater safety and longer life.
7. UNIFLEX fittings are shorter and more compact than most others. This permits the use of more hose length and less fitting length—gives far greater maneuverability, makes it easier to get in and out of tight places.

UNIFLEX is supplied in measured lengths, properly fitted and ready for use. You can buy it in sizes from $\frac{1}{4}$ " to 6" ID. It has already proved itself in such applications as hydraulic lines, oil burners, refrigeration machinery, air conditioning equipment, pumps, compressors, diesel engines and machine tools. Our Designers and Engineers have a thorough knowledge of its behavior under exacting conditions. If you'd like to know what UNIFLEX can do for you write us about your problem. We'll be glad to help you—without obligation.



Send for your free copy of our new UNIFLEX Catalog. It contains full technical data, sizes, fittings, suggestions for use, and information about new UNIFLEX Quick-soldered Couplings.



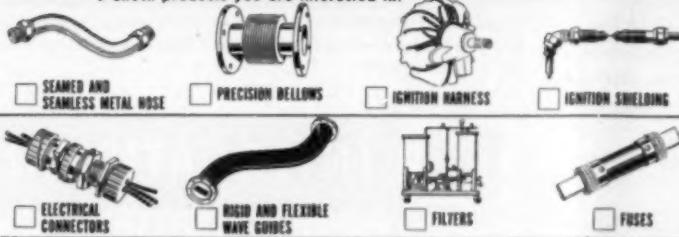
Note the Helically-corrugated, seamless wall structure of UNIFLEX.



UNIFLEX vibration eliminator used between circulating coils and compressor of a General Electric air conditioning unit. Motor-compressor unit is spring-mounted, requires a flexible connection.

Let Our Family of Products Help Yours

Check products you are interested in.



Titeflex

TITEFLEX, INC.
501 Frelinghuysen Ave.
Newark 5, N.J.

Please send me without cost information about the products checked at the left.

NAME _____

TITLE _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



"That's What a Man Likes in a Tractor"



Hard-working International TD-9 scores big in Indiana quarry

The Corydon Stone Company at Lanesville, Indiana, has numerous hurry-up calls for its trouble-shooting TD-9. Dozing crushed stone, pushing chips up on a 40-foot stock pile and cleaning around the crusher are only a few of the tasks it does better and faster.

Operator Steve Bachman says:

"I've operated crawler tractors going on thirty-one years, and I like Internationals better than all the others. The TD-9 really goes to the job in a hurry and gets the job done. That's what a man likes in a tractor!"

Make a date with your local International Industrial Distributor. He'll give you brass-tacks proof of how International power gets out the work. He'll show you fully-equipped repair shops, factory-trained men and full stocks of spare parts. You'll know that his customers are assured of long, profitable service from every piece of equipment he sells.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILL.



PILING UP THE CHIPS. International TD-9 gets all kinds of tidy-up and stock piling jobs done in a hurry, and proves itself a useful quarry hand.



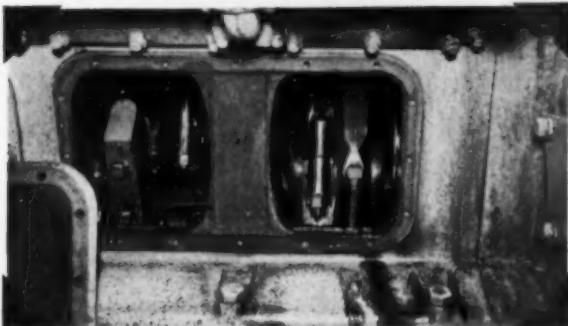
INTERNATIONAL
POWER THAT PAYS

THE ENGINEER'S REPORT

DATA
RPM Delo Oils

LUBRICANT	Caterpillar D-375 diesel
UNIT	Coastal fishing— bottom fish
SERVICE	Constant load
CONDITIONS	A. Paladini, Inc. Fields Landing, Calif.
FIRM	

Heavy-duty engine clean after 4146 hours' work!



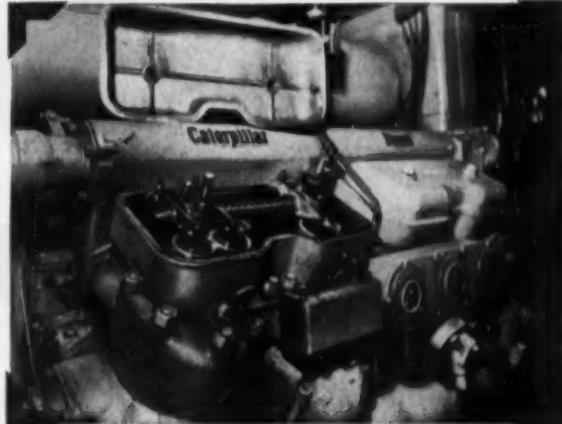
AFTER 4146 HOURS of steady work in the 270 H.P. supercharged diesel propulsion engine of the Catherine Paladini below, note how clean and free from deposits RPM DELO Supercharged-2 Lubricating Oil has kept parts. Crankcase drains and filter changes at 1500-hour intervals have shown no sludge, according to Axel Bjork, Skipper. He says, "The engine ran perfectly during the more than 4000 hours of tough work—if anything, it runs better now than at first."

THE 73-FOOT-LONG CATHERINE PALADINI has a 19.6 beam. She fishes from Oregon to San Francisco, bucks heavy seas and tides on trips that last from three days to over a week. Seas were exceptionally heavy during the past winter, giving her new engine an extra tough workout.



NOW...
You can cut engine wear
rate as much as 85%.

FREE BOOKLET on
the RPM DELO Oils
gives you complete
information. Write
or ask for it today.



How RPM DELO Oils keep engines clean and prevent wear



- A. Contain special additives that provide metal-adhesion qualities...keep oil on parts whether they are hot or cold, running or idle.
- B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean, helps prevent scuffing.
- C. Special compounds stop corrosion of any bearing metal, and oil foaming in both wet and dry sump engines.

STANDARD TECHNICAL SERVICE checked this product performance. For expert help on lubrication or fuel problems, call your Standard Fuel and Lubricant Engineer or Representative; or write Standard Oil Company of California, 225 Bush St., San Francisco.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

This test tube holds $\frac{3}{5}$ ounce of fuel oil

enough
to haul

one ton

three miles

when used in
a General Motors Diesel
locomotive

If all oil- and coal-burning steam locomotives were replaced by Diesels, America would save 182,500,000 gallons of fuel oil and 62,000,000 tons of coal per year.

TO CONSERVE FUEL AMERICA NEEDS MORE DIESELS!

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

LA GRANGE, ILLINOIS—In Canada: GENERAL MOTORS DIESEL, LTD., LONDON, ONTARIO

If you are interested in the conservation of fuel by Diesel locomotives, write Electro-Motive Division for a recent study.

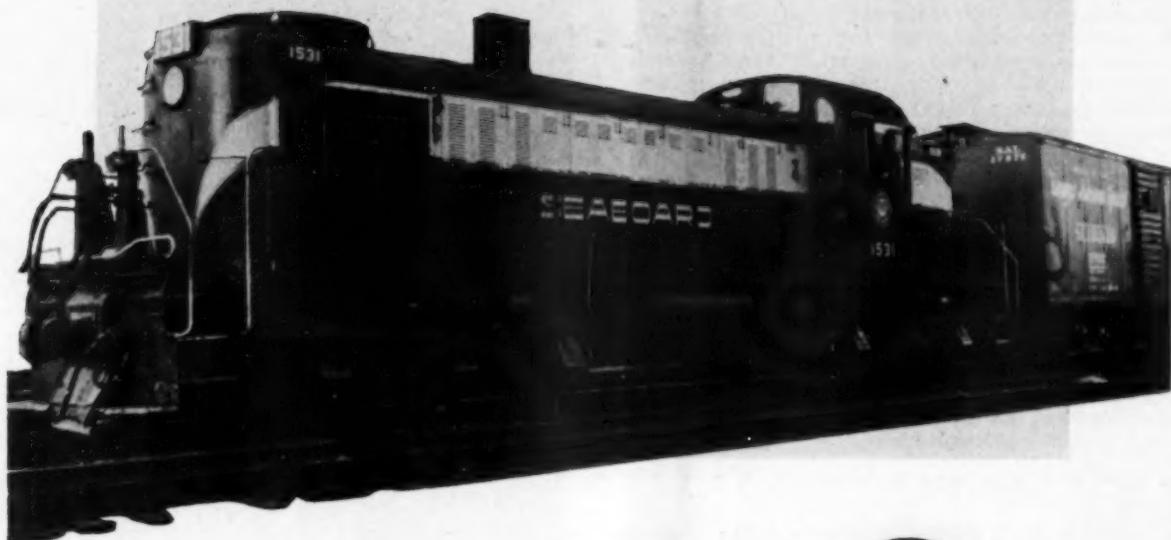


DIESEL PROGRESS

The oil with 3-way action that keeps railway Diesels clean

GULF DIESELMOTIVE OIL

- 1 Fights piston ring belt deposits (effective detergent action).
- 2 Resists sludging (high stability).
- 3 Prevents hard deposits on piston crowns (base stock quality and refining methods).



These are the reasons why Gulf Dieselmotive Oil protects against the accumulation of harmful deposits on compression and oil-control rings, on piston crowns, and in ports. Because engines lubricated with Gulf Dieselmotive Oil stay cleaner, they use less oil and require ring jobs less often. This means lower maintenance costs and less time off the road. For further information, write, wire, or phone your nearest Gulf office.



GULF OIL CORPORATION
GULF REFINING COMPANY
PITTSBURGH 30, PENNSYLVANIA

YOUR PROOF OF EFFICIENCY

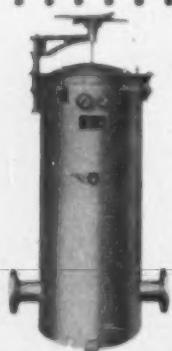
HOFFMAN FILTERS

Deliver Dependable, Low-Cost Service for Power Generating Plants Like These:

WOLVERINE ELECTRIC COOPERATIVE, INC. — At the Johnson Plant in Hersey, Mich., which won the 1953 "Diesel Progress" Efficiency Award, Hoffman Cartridge Filters and 300 g.p.h. Oil Conditioner contribute to lube and fuel oil clarity. Shown above is the Hoffman oil conditioner unit used for batch purification of lube oil. Soluble contaminants are driven off by the vaporizer in this unit and abrasive solids are removed by its cartridge filter component. In addition, three Hoffman Cartridge Filters, with 7x18 throwaway cellulose cartridges, serve each of the Fairbanks Morse 3,500 H.P. engines with lube oil on a by-pass basis. A fourth Hoffman filter handles fuel oil for these machines.

IOWA POWER & LIGHT CO. — For its program of preventive maintenance covering 24 substations in a territory radiating 150 miles from Des Moines, this company uses a 300 g.p.h. Hoffman Oil conditioner mounted on a truck chassis. Transformer and circuit breaker oils can be quickly restored to safe operating limits in this manner. The reclaimer is quickly connected to the equipment. It is easily operated — requires no highly skilled or trained technical personnel. The Hoffman oil conditioner has demonstrated year-round dependability in this company's campaign against oil sludging and oxidation.

CORN BELT POWER COOPERATIVE, Humboldt, Iowa — Since 1950, this truck-mounted Hoffman Oil Conditioner has traveled this system's 12,344 miles of transmission lines to keep transformer and circuit breaker oils at safe operating levels. This method has proved convenient, quick and economical. The 300 g.p.h. conditioner is quickly connected to equipment for recirculation of oils through the filter using Fuller's earth to remove solid particles of carbon, products of oxidation such as organic acids, gums, resins and asphaltines resulting from operation of the transformer at high temperatures. Filtered oil then passes through a vaporizer which dehydrates and degasifies the oil to produce an end-product free from oil contamination and moisture and having safe dielectric strength limits.

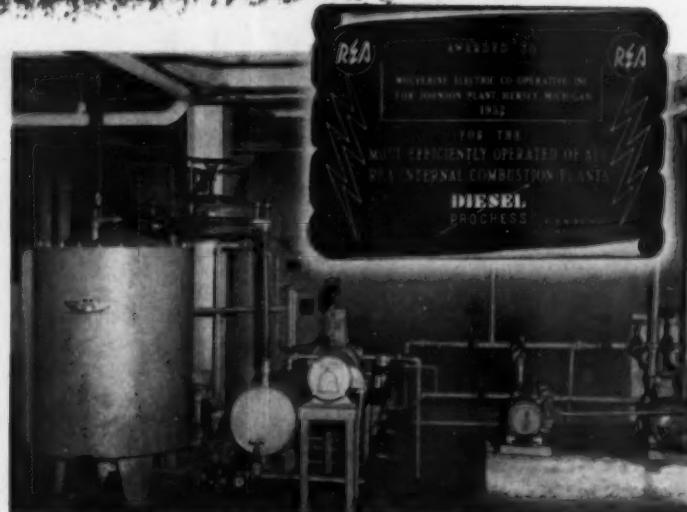


The HOFFMAN FLO-master

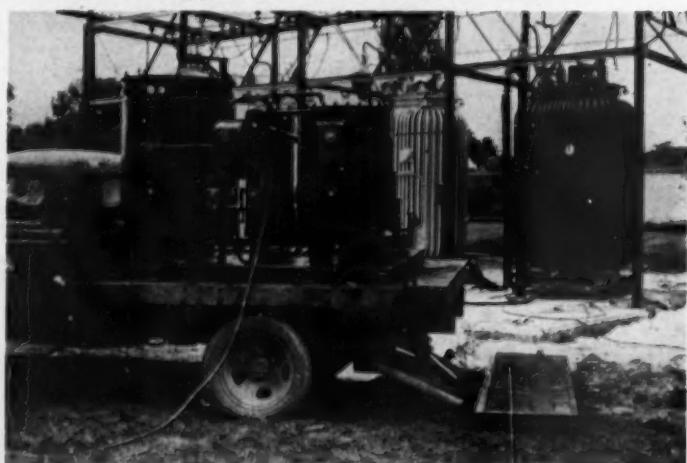
A full-flow filter to remove lube oil abrasive particles down to 20 microns or smaller. Minimum initial pressure drop. Exclusive throwaway cartridge with 45 sq. ft. of filter area. Sizes from 75 to 900 g.p.m. Write for Bulletin A-873.



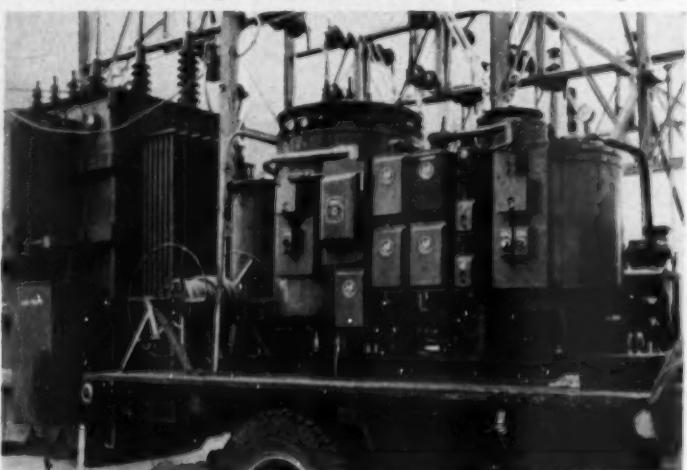
HOFFMAN Oil Conditioners. Complete reclamation of used oils. Remove both soluble and insoluble impurities. Capacities for 25 to 600 g.p.h. Write for Bulletin A-667.



Hoffman 300 g.p.h. oil conditioner for lube oil reclamation.



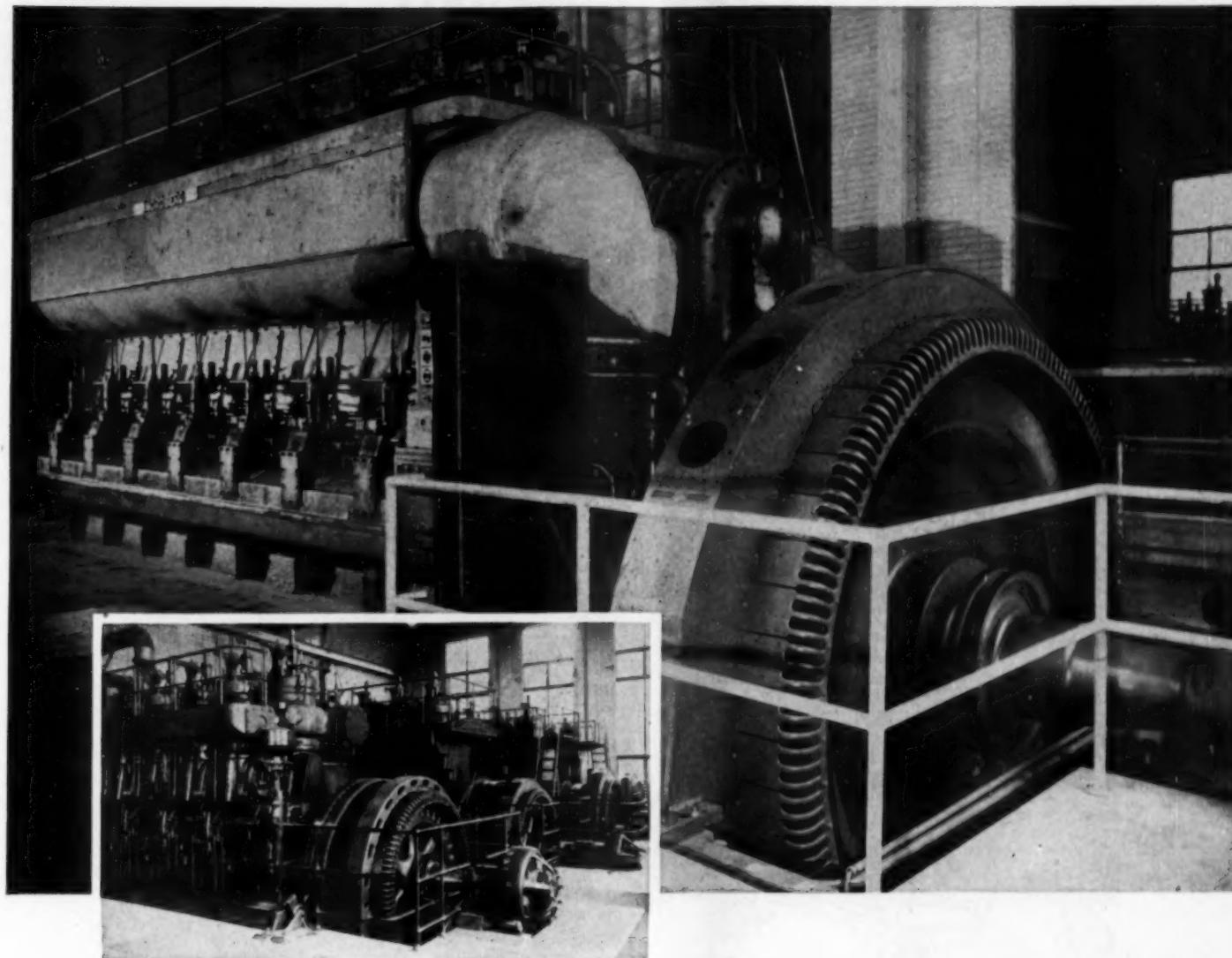
Iowa Power & Light mobile unit for reconditioning insulating oils.



Hoffman Oil Conditioner, as "mobilized" to recondition insulating oils for Corn Belt Cooperative.

IN CANADA
Hoffman Filter Company, Ltd.
Montreal, Quebec

Hoffman INDUSTRIAL FILTRATION DIVISION
U. S. HOFFMAN MACHINERY CORPORATION
232 LAMSON STREET, SYRACUSE 1, N. Y.



Rensselaer, Indiana, plant gets record economy with...

• Shown above are the five diesel engines, totaling 7,150 hp., which make the Rensselaer municipal plant one of the largest of its kind in Indiana. The efficient operation of these diesels has helped keep Rensselaer's lighting rates among the lowest in the state for cities in the 2,500 to 10,000 population group.

Contributing to this successful record, Standard Oil's diesel fuel and lubricants have helped keep operating and maintenance costs low. STANDARD HD Oil has played a particularly important role. This outstanding heavy-duty lubricant has provided effective lubrication of vital cylinder areas. It has kept cylinders and rings protected against excessive wear and free from deposits. How these benefits contribute to high operating efficiency is shown by the performance of the plant's newest and largest diesel, a 2,800-hp unit. In a typical month, this unit has operated for 444 hours, carried an average load of 54%, and generated 13 kw-hr per gallon of fuel with a lubricant consumption rate of 9,414 hp-hr per gallon.

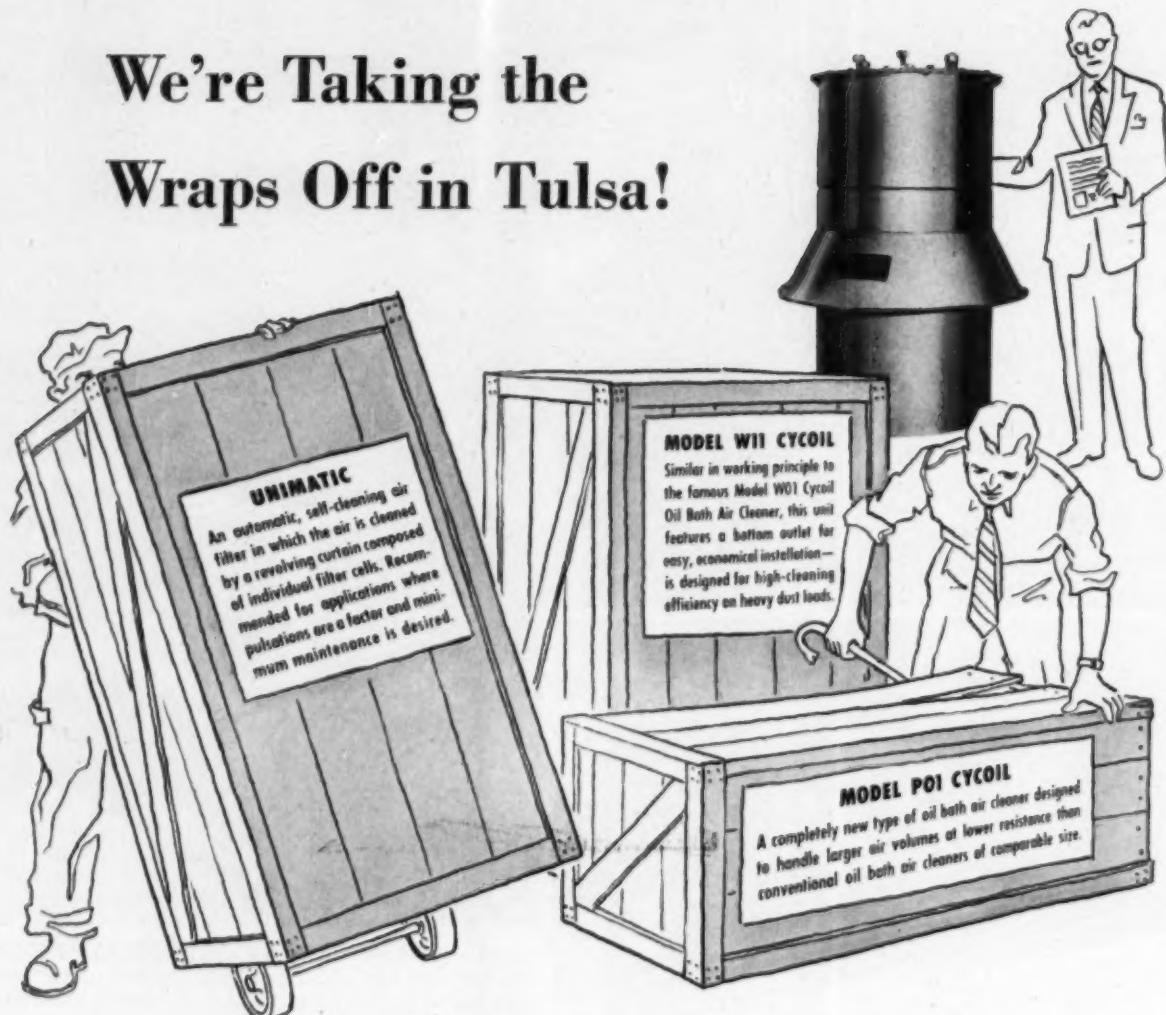
Throughout the Midwest, diesel operators are getting record efficiency and economy with the help of STANDARD HD Oil. The Standard Oil lubrication specialist in your area will be glad to give you information concerning the use of this superior heavy-duty lubricant in plants with which you may be familiar. Just phone your local Standard Oil Company office for his services. Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD HD
TRADE MARK
OIL



We're Taking the Wraps Off in Tulsa!



3 New AAF Intake Air Filters

TO BE INTRODUCED AT INTERNATIONAL PETROLEUM EXPOSITION

Step right up to Booths 16-17 and meet these newcomers to the AAF line of intake air filters for engines and compressors. Regular size working models of all three will be in operation so that you can get a firsthand demonstration of their many new and practical features.

Other AAF units on view for your inspection will be the Type OC, a unit viscous filter, and the Type

PL-C, a dry type filter with disposable media. As always, experienced American Air Filter engineers will be available at all times to interpret these filters in terms of your specific equipment and dust problems.

If you value your engine and compressor investment, your time will be well spent at the AAF exhibit. Let's get together in Tulsa!

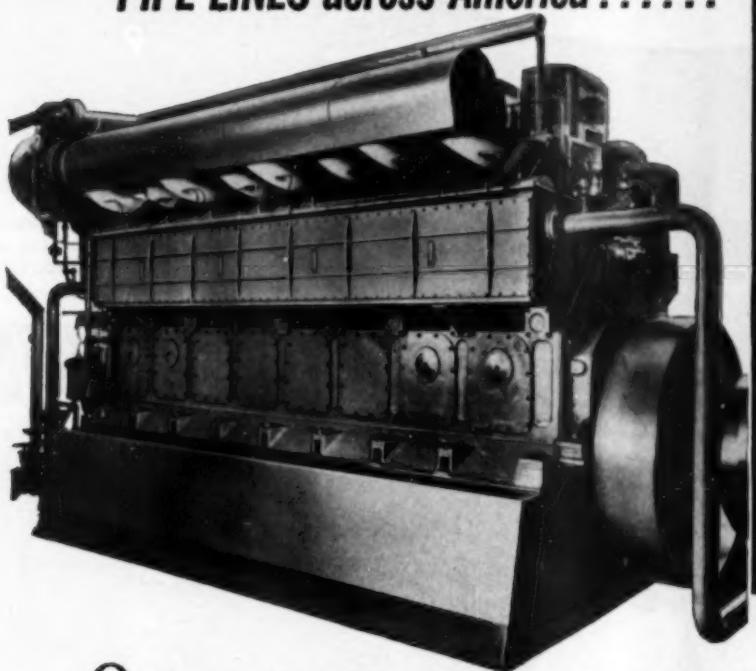
You Can Expect the Best From

American Air Filter
COMPANY, INC.



408 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

*On the CRUDE OIL and PRODUCTS
PIPE LINES across America*



The trend
is toward
NORDBERG
POWER!

ON the crude oil and products pipe lines across America, the trend is toward Nordberg SUPAIRTHERMAL* engine power. The reasons are simple and sound . . . because SUPAIRTHERMAL engines produce more power in less space—substantially reducing installation and operating costs. What's more—the efficiency of these powerful engines is made possible through a patented inlet valve timing control which turns low fuel consumption rates into profit dollars at the end of the line.

Nordberg SUPAIRTHERMAL engines are available in a full range of four-cycle types from 535 to 4260 hp for Diesel, Duafuel® or spark-fired gas operation. The SUPAIRTHERMAL principle of operation increases the engine's load-carrying ability at any given speed, over a wide speed range. This reserve power is like "money in the bank" when additional line capacity is needed.

For further details, send for Bulletin 191.

*Trademark

NORDBERG MFG. CO., Milwaukee, Wisconsin



DIESEL • DUAFAUL® AND
SPARK-FIRED GAS ENGINES

0-153

B
U
D
A

**Pulls 10,300 ft.
string with ONE
BUDA MOS-1290!**



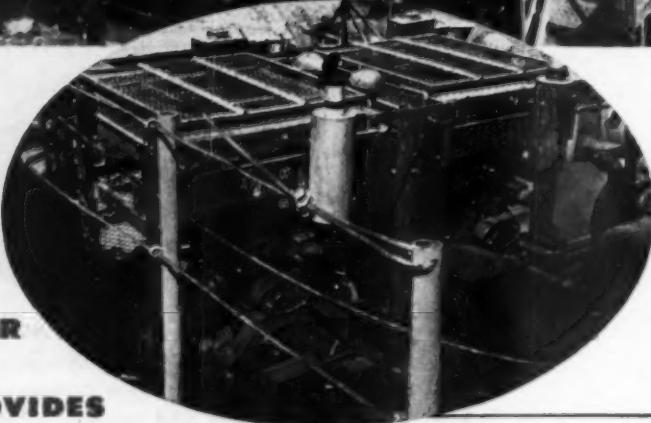
**Buzzini Drilling Co.'s Wilson Giant
Torcair Remote Control rig is power-
ed by three Buda MOS-1290 engines
with torque converters.**

Buda-

TORQUE CONVERTER

COMBINATION PROVIDES

Big Power FOR BUZZINI RIG



**Close-up of the Buzzini
rig's two compounded Buda MOS-
1290 pump and drawworks engines.
Note top mounted radiators.**

Buzzini Drilling Company's No. 6 rig, on location in Zavada County, Texas, was down to 10,300 ft. in a diamond coring operation. One of the Buda MOS-1290 engines powering the drawworks developed minor valve trouble. Rather than risk possible damage to the engine, it was decided to come out of the hole with the remaining Buda. Starting off the bottom, it was necessary to pull 250,000 lbs. to get through a tight spot, but the single Buda Engine Torque Converter combination pulled the pipe without trouble in less than five hours.

Performance like this is why Budas are called "drillers' engines" . . . engines built to deliver the "big power" and extra stamina that pays dividends in the oilfields. Whatever your requirement — high speed engines for torque converter combinations or medium speed, heavy duty engines — if it's oilfield power . . . BUDA HAS IT!

Ask your Buda Oilfield Distributor for details. The Buda Company, Harvey, Ill.

BUDA OILFIELD DISTRIBUTORS
Dallas • Tulsa • Los Angeles • Houston • Oklahoma City • Seminole • Wichita Falls • Shreveport • Bakersfield • Tinsley • Pampa
Great Bend • Long Beach • Kilgore • Mt. Carmel, Ill. • Alice • Odessa • Casper • Denver • Brookhaven • New York City (Export) and in Canada at Calgary and Edmonton

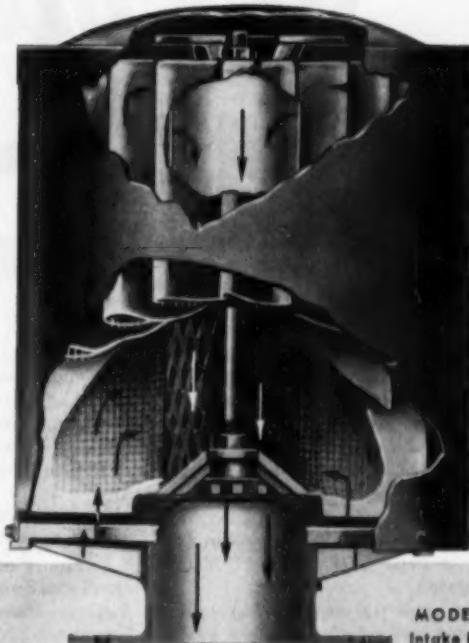
STAYNEW INTAKE FILTERS GIVE GREATER EFFICIENCY plus POSITIVE PROTECTION

IT'S A FACT! A filter which is 99.9% efficient is *9 times* as effective as one that is 99.0% efficient. Why?—because the filter that is 99.9% efficient lets only *one-ninth* as much dirt into the engine. And, it's the dirt that *gets in* that causes the trouble.

The extreme efficiency of Staynew Intake Filters provides *positive protection*—keeps shutdowns and repairs at an absolute minimum. Efficiency actually increases with use. Staynew Intake Filters are efficient over a wide range of loads and are not affected by temperature changes. And, Staynew Intake Filters effectively protect vital engine parts without carefully held maintenance schedules . . . frequently operating two or more years without attention.

Get all the facts. Write today for Bulletin S.I.F.

Representatives in Principal Cities



MODEL D
Intake Filter



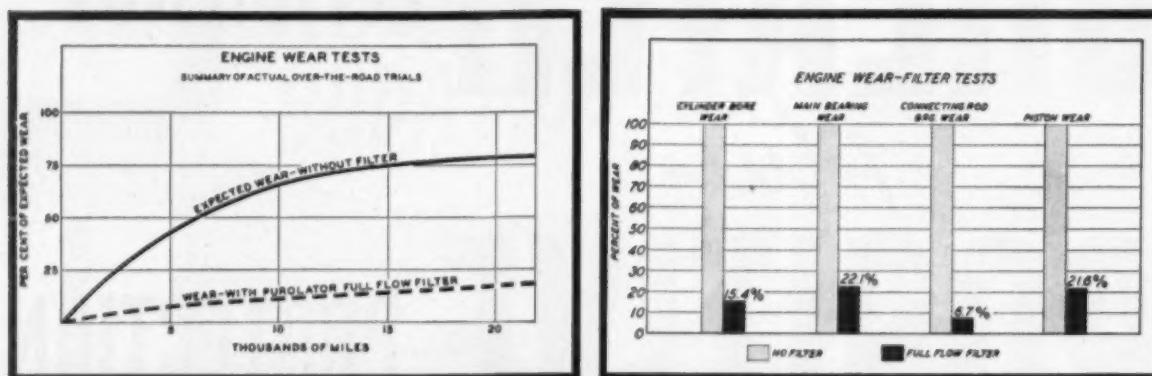
DOLLINGER

CORPORATION

12 Centre Park, Rochester 3, N.Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Why leading automotive manufacturers say



It's *Purolator** for
Full-Flow!

In the charts above, you see summaries of important filter research programs, conducted independently by two of the world's largest automobile and truck manufacturers.

These were exhaustive investigations, taking several years to complete, in which virtually every available type and make of filter were tested.

What were the results? *Purolator* filters out-performed all others by a

significant margin. In severe over-the-road tests of trucks and passenger cars, *Purolator* Full-Flow filters held engine wear to such an amazing minimum that often it was unmeasurable . . . while control vehicles without filters had to have complete engine overhauls.

In many other comparative tests, conducted by vehicle and engine manufacturers themselves, *Purolator* filters have been proved best . . . in fineness

of filtration (.0000039 in.), in filtering area, in dirt storage capacity and in durability.

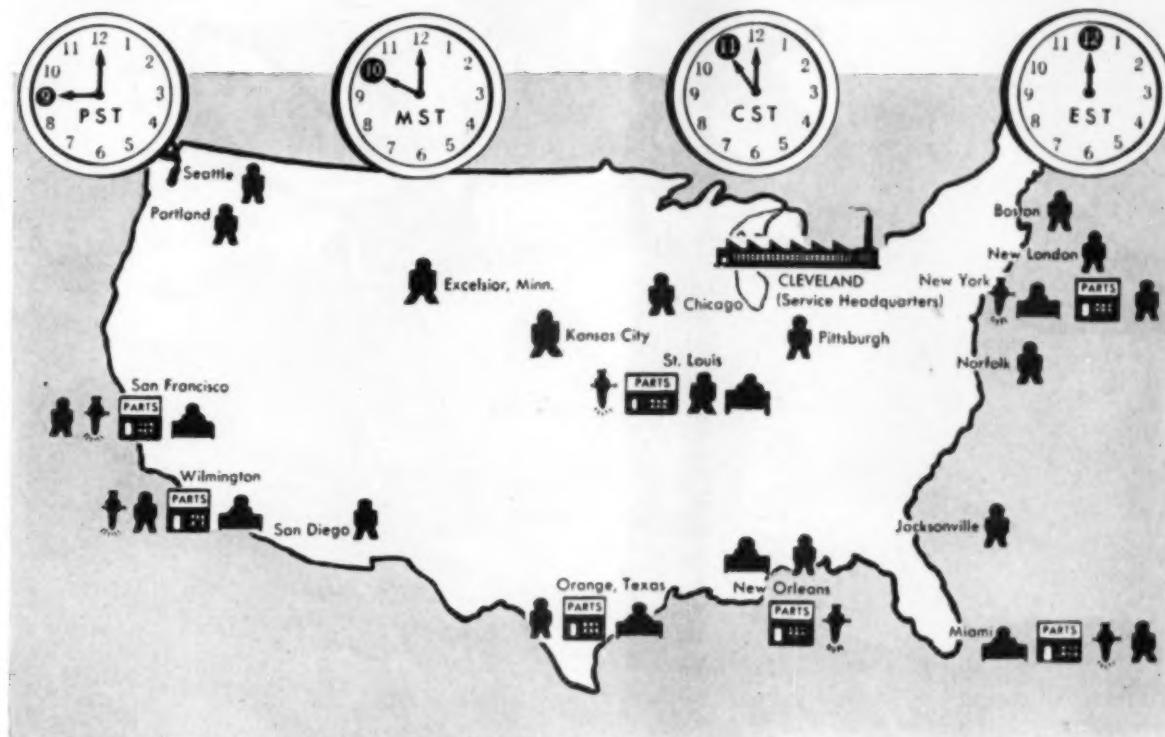
If you want further proof of *Purolator*'s superiority, why not make your own tests . . . in your own way . . . under your own conditions? *Purolator*'s Engineering Department will gladly co-operate in helping you adapt modern, super-efficient *Purolator* Full-Flow filtration to your own requirements.

*Reg. U. S. Pat. Off.

PUROLATOR PRODUCTS, INC.
Rahway, New Jersey and Toronto, Ontario, Canada
Factory Branch Offices: Chicago, Detroit, Los Angeles



LOCAL SERVICE 'ROUND THE CLOCK



LEGEND: Service Engineers (Total 105) Injector Repair Parts Stock Offices

Prompt and efficient service by qualified General Motors engineers is available 'round the clock.

These trained representatives assure the satisfactory operation of Cleveland Diesel engines for shipyards and ship operators. To back up this service, offices and parts stocks are conveniently located throughout the country.

CLEVELAND DIESEL ENGINE DIVISION



GENERAL MOTORS • CLEVELAND 11, OHIO

Tie up to GM Service

ENGINES FROM 150 TO 2000 H.P.



Sales and Service Offices: Cambridge, Mass. • Chicago, Ill. • Jacksonville, Fla. • Miami, Fla. • New Orleans, La. • New York, N.Y. • Norfolk, Va. Orange, Texas • San Diego, Calif. • San Francisco, Calif. • Seattle, Wash. • St. Louis, Mo. • Tampa, Fla. • Washington, D.C. • Wilmington, Calif.



...with TYCOL lubricants on hand!

Top this record! A well known utility company has operated a turbine for *almost 12 years* without an oil change or cleaning. At a rate of less than 10% "make-up" per year, Tycol Aturbrio has served the plant without malfunction — for years on end. And Tycol Aturbrio performance records show turbine after turbine running well over 100,000 hours without a change! That's *proven stability* ... further substantiated by the regular use of Aturbrio as an outstanding hydraulic oil. Full data on Aturbrio performance is available from your local Tide Water Associated office.

Over 300 Tycol industrial lubricants are at your disposal ... engineered to fit the job!

REFINERS AND MARKETERS OF VEEDOL... THE WORLD'S MOST FAMOUS MOTOR OIL



Boston • Charlotte, N. C. • Pittsburgh
Philadelphia • Chicago • Detroit
Tulsa • Cleveland • San Francisco
Toronto, Canada





Here's why Young-designed and built tube and plate fin cores give greater heat transfer efficiency . . . stand up better under peak capacity operation . . . pay bigger dividends in longer trouble-free service. The outstanding design and construction of the Young plate type fin core, shown above, features specially deformed reinforced collars which make it a continuous, permanent bond between fins and tubes . . . providing maximum heat transfer and greatly stronger, longer-lasting cores.

This mechanical structure of greater strength which permits the use of the most desirable metals chosen for the job—copper, aluminum or other alloys—is attributable to Young's precision-manufactured, high-quality cores.

Whatever your need, consult your nearest Young Sales Representative to help you select correct cores—types and sizes—and discuss any phase of your heat transfer problems.



One of our many important installations is the Reynolds Metals Company's new San Patricio, Texas plant which uses more than 80 Young units featuring the new "bonus" core for cooling engine jacket water and lube oil, and 91 additional units of Young varieties, specially designed construction.

YOUNG

HEAT TRANSFER PRODUCTS FOR
AUTOMOTIVE AND INDUSTRIAL
APPLICATIONS.

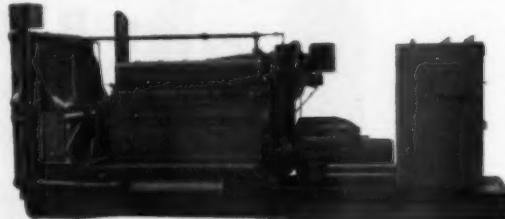
HEATING, COOLING, AND AIR
CONDITIONING PRODUCTS FOR
HOME AND INDUSTRY.
T.M. REG. U.S. PAT. OFF.

YOUNG RADIATOR COMPANY

Dept. 403-E • RACINE, WISCONSIN
Factories at Racine, Wisconsin, and Mattoon, Illinois



Two 1000 KW units in a
Midwestern Public Utility.



500 KW Package Unit for construction work,
standby or emergency power, etc.

MORE POWER

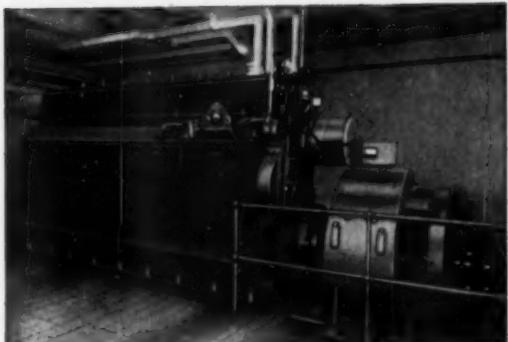


You get tops in power performance and dependability at low operating cost with CP Diesel, Dual Fuel, and Gas Engines. Efficient CP engines are available in sizes capable of delivering from 120 HP to 1750 HP, and in normally aspirated or supercharged models.

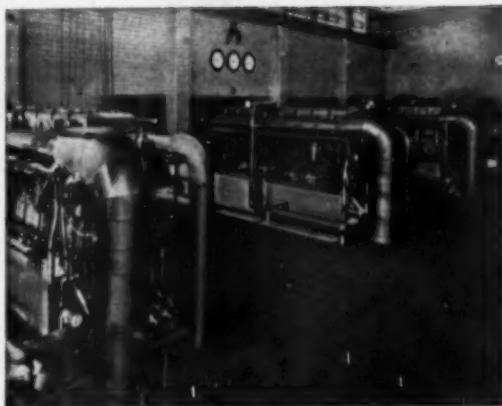
Widely used in all types of industries where low cost reliable power is required, CP Diesel Engines are also ideally suited for utilities, institutions, sewage works, and other applications. Write for more detailed information. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*



to you—at less cost



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Sewage Gas Engines in a large
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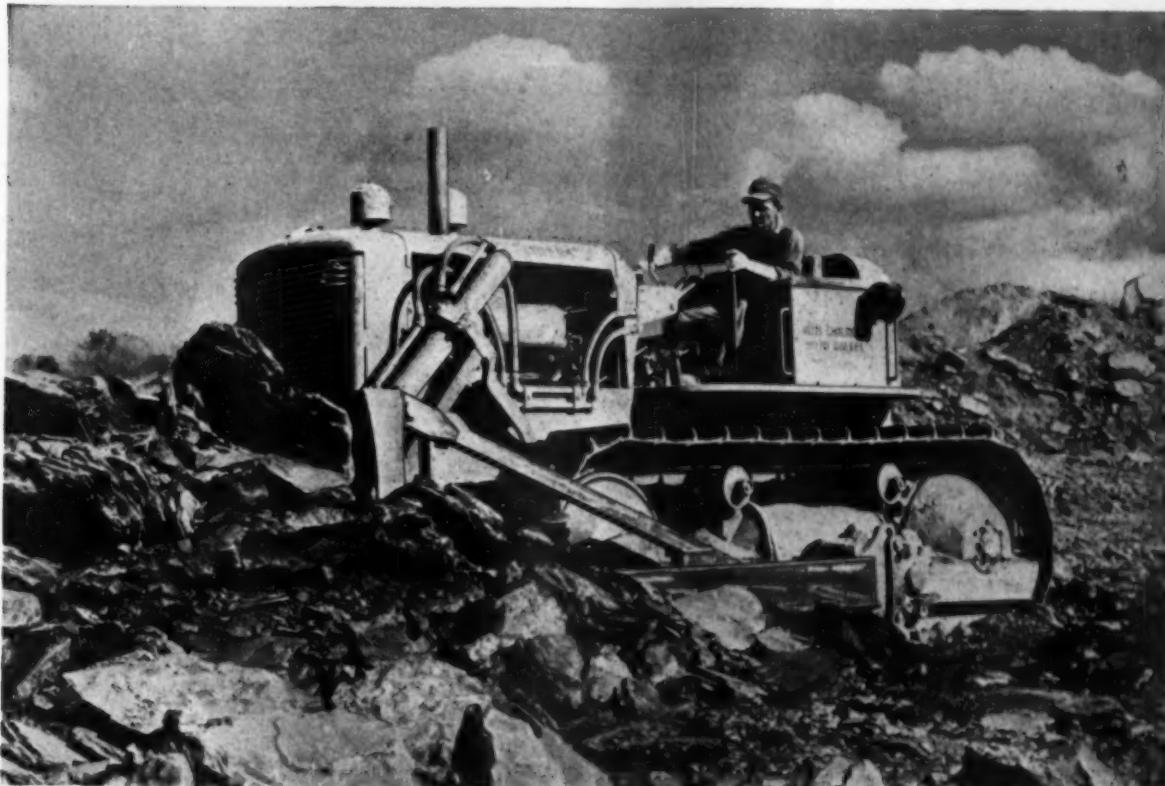


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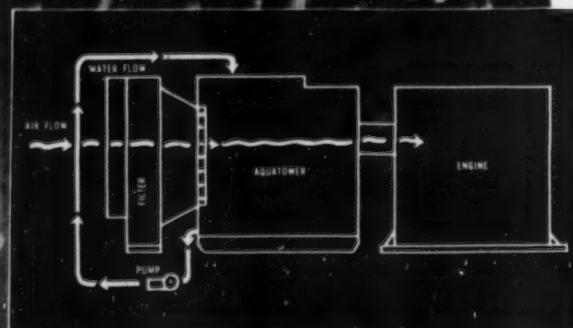
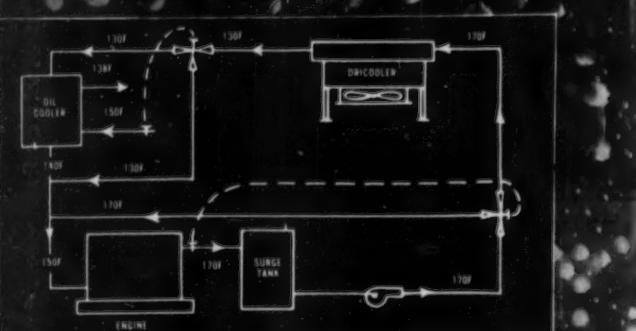
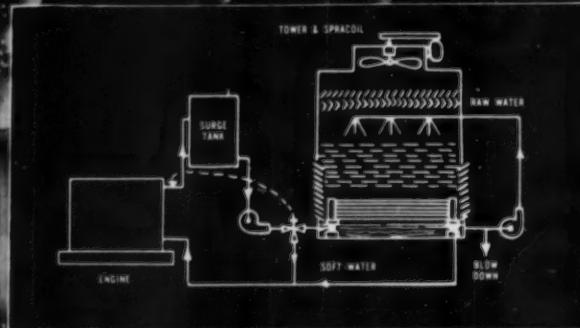
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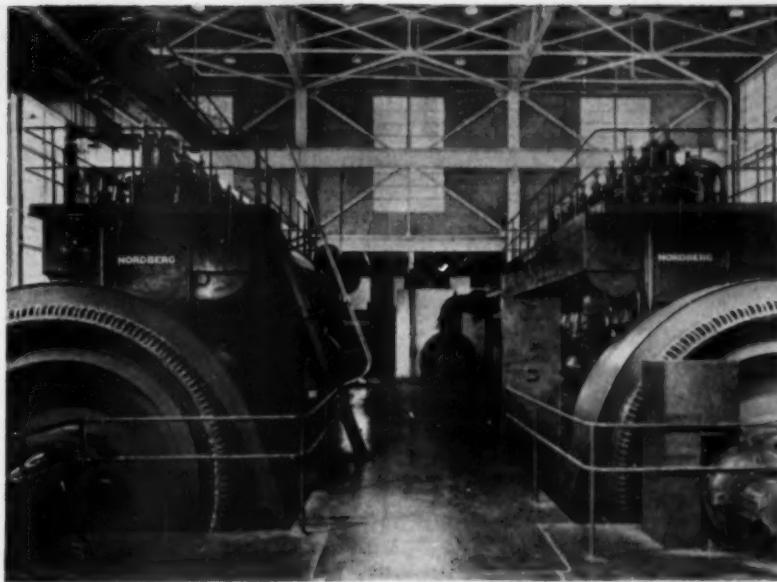
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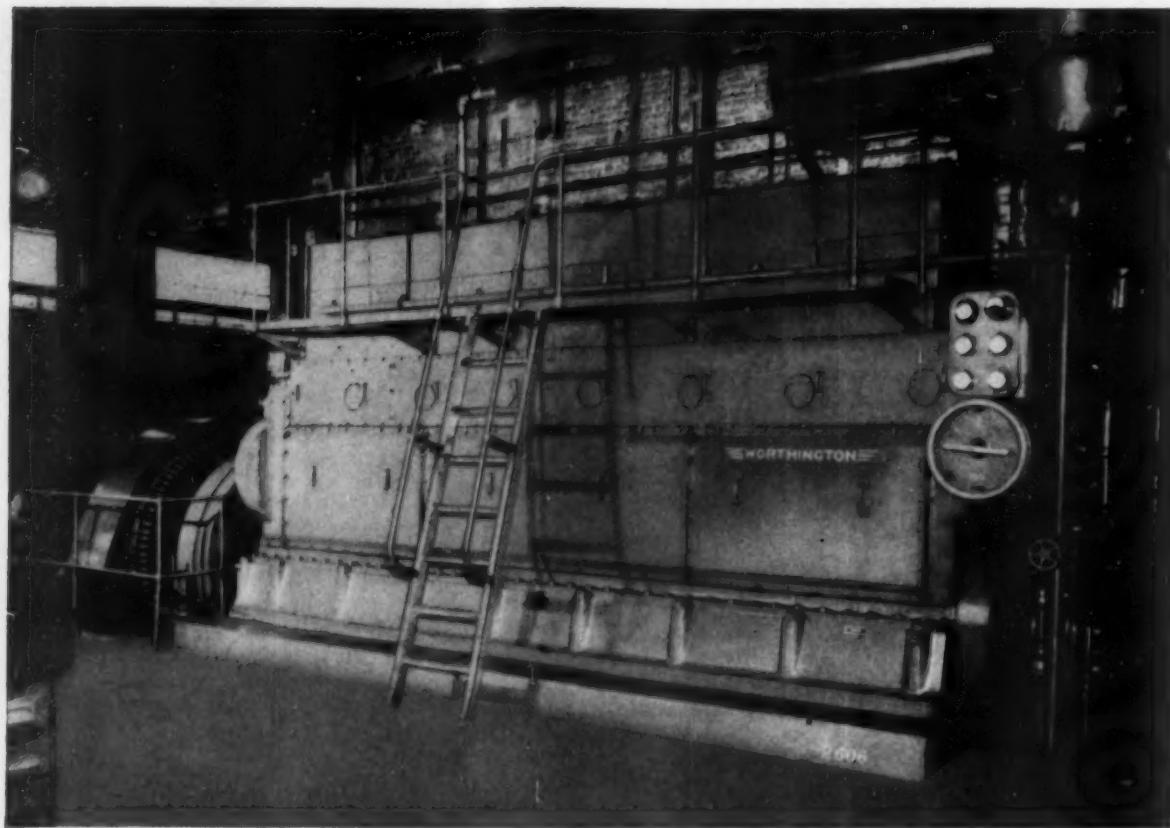


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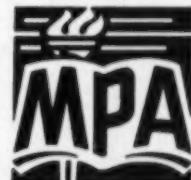


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TURBOSUPERCHARGERS FOR SMALL DIESELS

By W. D. WOOD*

THE diesel industry, more than ever before, is turning to the high performance of the turbosupercharged engine to increase efficiency and decrease engine size and weight. Many new engines will be turbosupercharged in 1953, and most of these new applications will be on diesels for 600 hp. and below. This advance is the joint success of engine and turbosupercharger designers working towards the same goal—higher performance diesels.

Diesel performance is increased by turbosupercharging beyond the inherent limitations of naturally aspirated and mechanically supercharged engines. Because recent years have seen diesel performance continuously increased until now most designs are close to the safe and dependable limits for engine speeds, compression ratios and weight reduction, the turbosupercharger is becoming increasingly important in new engine designs. This engine accessory provides a basically simple method of increasing the power of a given size engine—it forces more air into the combustion chamber so that more fuel can be burned. But, it doesn't have the limitations of a supercharger driven from the engine drive shaft; for beyond a limited pressure level, the geared supercharger takes so much power from the engine shaft that fuel consumption becomes excessive or the net power output may even decrease, and, these disadvantages are greatly increased when the engine operates at "high idle" or partial load—high speed conditions which are experienced on such applications as generator sets, tractors, trucks, drag lines, and most direct-connected drives.

The turbosupercharger avoids these limitations because: 1. It uses power from the engine exhaust gases rather than the drive shaft, thus adding nothing to friction-horsepower losses, but actually decreasing fuel consumption. 2. Its output varies with both engine load and speed, rather than speed only as in the case of a geared supercharger. Thus, excessive pumping of air at high-speed, part load conditions is avoided. The turbosupercharger will also maintain close to sea level horsepower at altitude, because it automatically raises its charging pressure-ratio as the ambient air pressure decreases. These self-compensating characteristics are inherent in turbosupercharger thermo-dynamics, and require no controls or special attachments.

The application of turbosuperchargers has been evolved for smaller diesel engines largely in the past several years. It has required development of optimum valve timings, correct compression ratios, and combustion chambers yet the turbosupercharger story is equally as interesting as the engine story. Although not as complex as the engine, the

*Small Turbine & Supercharger Dept., General Electric Co

turbosupercharger has had to overcome difficult problems of high rotating speeds, high temperatures, and difficult efficiency and dependability requirements.

The General Electric Model 7S-RA and 7S-RB turbosuperchargers now being produced in quantity for the Packard 300 hp. and 600 hp. marine diesels represent an interesting solution to advanced and difficult supercharger requirements. While on a standard engine operating schedule they are designed to give 10,000 hours of operation between overhauls. Thus their design has had to achieve both high performance and long life. This has been done by incorporating advanced gas turbine techniques as well as well-known features of larger turbosuperchargers. Although these superchargers were specifically designed for the marine application their design includes provisions for extension and modification to other more general fields of turbosupercharging, as well as high pressure supercharging. Several models have been designed for specific applications to the advanced high performance diesels in the 200 to 600 hp. range. Under maximum conditions some models are capable of supplying up to 20 psig. air pressure with a 1350° F. turbine inlet temperature. Figure 1 is a model designed for a 500 horsepower diesel operating with a 20 psig. air manifold pressure. This model is equipped with an original, double-radial turbine inlet arrangement. Fig. 3 is a 7SRA model for 200 to 400 hp. engines. Fig. 2 is a 7SRB2 model for 400-800 hp. engines. Both of these latter models operate at a medium pressure level in the range of 10 psig.

Basically, a turbosupercharger is a simple machine which converts the energy of the engine exhaust gases into compressed air for the engine air intake. Fig. 4 is a cross-section view of the Model 7SRB supercharger which illustrates the various supercharger parts. The exhaust gases enter the nozzle box, are expanded and directed through the nozzle diaphragm blades, and then impart their energy to the turbine wheel buckets before passing upwards through the exhaust passage. On the other end of the turbine shaft is a centrifugal compressor. This compressor induces air through the air inlet, throws it outwards and compresses it through the diffuser and forces it under pressure on to the engine. Surrounding this basic function are a few other parts—bearings, seals, water-cooled frame and casing, and miscellaneous hardware. Essentially, it is a simple machine with but one moving part.

The 7SRA and 7SRB superchargers illustrated in Figures 2 and 3 are designed for both light weight and sufficient strength to withstand "high-G" shock loading. The main casing and frame, compressor housing, diffuser, and impeller are aluminum. The

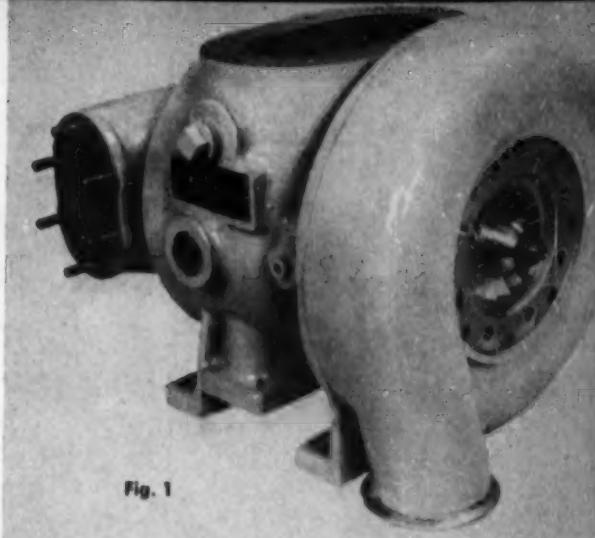


Fig. 1

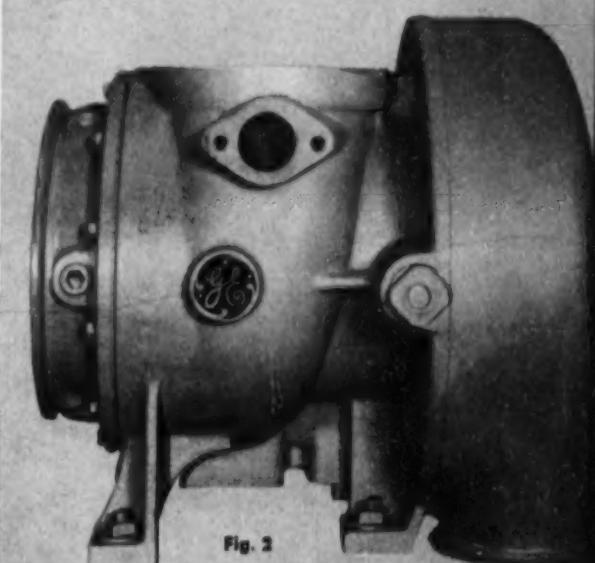


Fig. 2

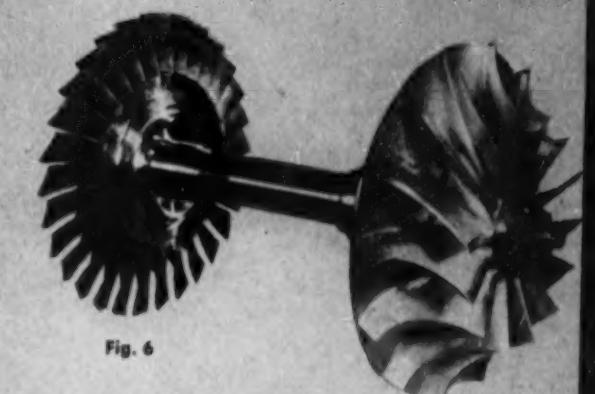


Fig. 4

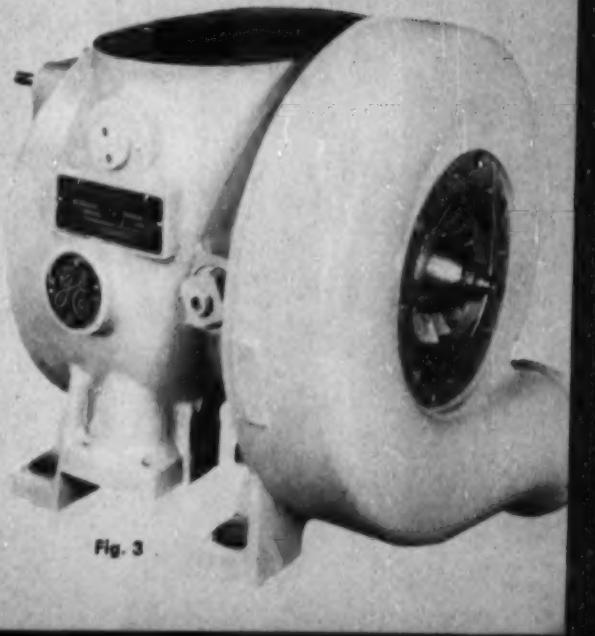


Fig. 3

Fig. 4

Compressor Casing and Diffuser Assembly

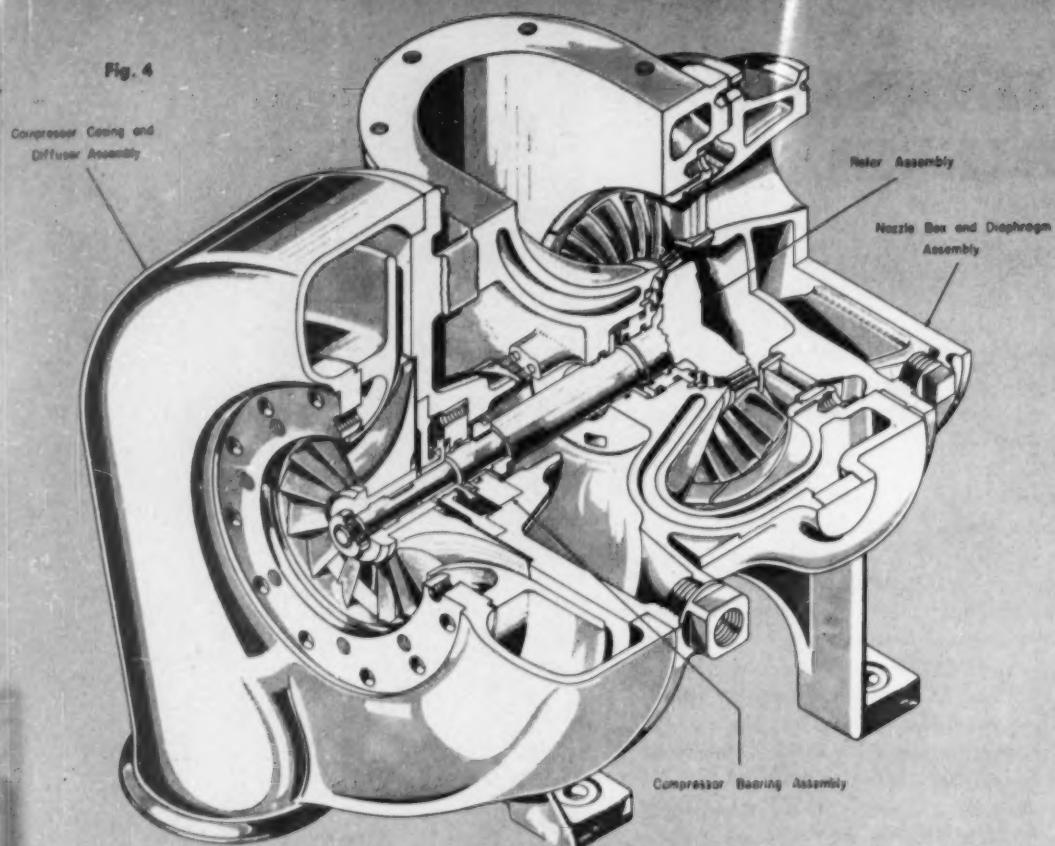


Fig. 7

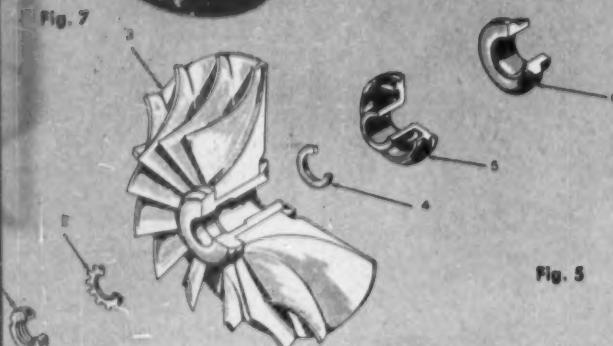
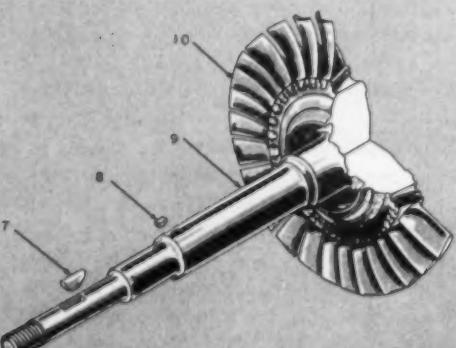


Fig. 5



- 1 Locknut
- 2 Lockwasher
- 3 Impeller Assembly
- 4 Spacer
- 5 Inactive Thrust Collar
- 6 Active Thrust Collar
- 7 Key
- 8 Key
- 9 Wheel and Shaft
- 10 Buckets

Fig. 8

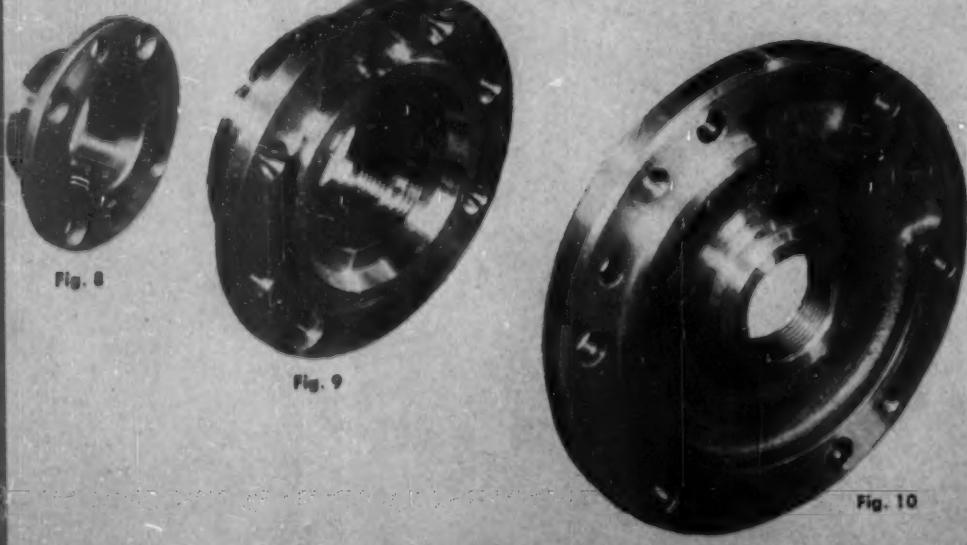


Fig. 9

Fig. 10

main frame is water-cooled, and all aluminum parts except the impeller are anodized to prevent corrosion from sea air. The impeller is not so treated to avoid possible embrittlement of this highly stressed part. The general design minimizes and simplifies repair and maintenance. Parts subject to wear or damage are easily replaced. The rotor assembly can be changed as a balanced unit so that balancing equipment is not necessary at all maintenance points. In operation, the units require no attention from the engine operator, and overhaul recommendations generally coincide with major engine overhauls.

A rotor assembly is illustrated by the exploded view in Fig. 5 and by a photograph, Fig. 6. The turbine buckets are precision, investment castings of high temperature alloy. They are attached to the rotor by an axial pine-tree dovetail. This dovetail fit is loose to provide damping of vibrations which may be stimulated in buckets during operation. The rotor blank is machined from a high temperature alloy forging; the rotor shaft is flash-welded to the rotor blank. The active thrust collar located at the compressor end, is keyed to the shaft, while the inactive thrust collar is part of the compressor end rotating oil seal and oil slinger. The compressor impeller shown in Fig. 5 is of the open type, milled from an aluminum forging. This impeller is driven through a key to the shaft. All these various parts of the rotor assembly are secured by a lock nut and washer.

Before placing in the supercharger, the rotor parts are assembled as a unit and brought to a very close dynamic balance. With the high operating speeds of over 30,000 rpm., it is important that close balance be achieved to eliminate excessive vibration. This is done by balancing both the turbine wheel and shaft, and the impeller separately, and then balancing those parts as a combined rotor assembly.

Bearings are extremely important in obtaining both stable and long life performance, for they must have low losses and vibration damping characteristics. The 7SRA and 7SRB models use a specially built, high grade bearing of tri-metal construction. For turbosuperchargers, sleeve type bearings have certain important advantages over roller type bearings. They are longer-lived, having no limited fatigue life, and they are not extremely sensitive to dirt, thus can operate on engine lube oil without special filtering. Generally, roller bearings have less friction losses, however, at extremely high speeds, this advantage lessens, and under some conditions may reverse. Considering the overall application requirements, it is felt the sleeve bearing gives longer and more dependable service.

Figs. 7 and 8 illustrate the 7SRB compressor-end, and turbine-end bearings. The compressor-end bearing assembly (Fig. 7) houses the longitudinal-groove type journal bearing, and both the active and inactive thrust bearing faces. This unit bearing assembly decreases the need for critical alignment techniques between the three bearing faces when placing the assembly in the unit.

The bearing oil seals for the 7SRB model are shown in Figs. 9 and 10. The seals are double-

acting; compressed air, bled from the compressor, forces oil back into the bearing housing, and the screw type labyrinth utilizes the viscous drag of oil running out the rotating journal shaft or the rotating seal to also work this oil back into the housing. The turbine seal, through action of the compressed air, also decreases fouling of the seal and bearing by exhaust gases working in behind the turbine wheel.

The turbine nozzle diaphragm (Fig. 11) expands and directs the exhaust gases through airfoil-type blades. The diaphragm is fabricated from stainless steel; the blades being welded to the outer-spacer ring, and mounted in free-fitting slots located in the inner spacer ring. This construction allows sufficient flexibility to accommodate expansion, which occurs at high operating temperature. The nozzle diaphragm is welded to the water-cooled turbine nozzle box casting.

The compressor diffuser receives high velocity air from the impeller and through its thermodynamically designed passages converts the energy of motion into pressure energy; close to half of the pressure rise occurs in the diffuser. Fig. 12 is the 7SRB Model diffuser, made of a one piece aluminum casting, anodized to minimize corrosion from sea air.

The compressor scroll and housing collects the compressed air discharged from the diffuser, and directs it around to the compressor discharge. It also comprises the compressor inlet flange. This is a one piece, anodized aluminum casting.

In the midst of the functional working parts of the supercharger is the bearing and exhaust casing which provides the supercharger frame and support. This casing (Fig. 13) is also a one piece anodized aluminum casting. It is rigidly designed to maintain the alignment of critical parts. Water passages cool the turbine end, which is subjected to high temperature exhaust gases.

Figure 14. Packard straight six diesel engine, model 2D-850 300 hp., equipped with General Electric 7SRA1 turbosupercharger. See DIESEL PROGRESS September 1952 issue.

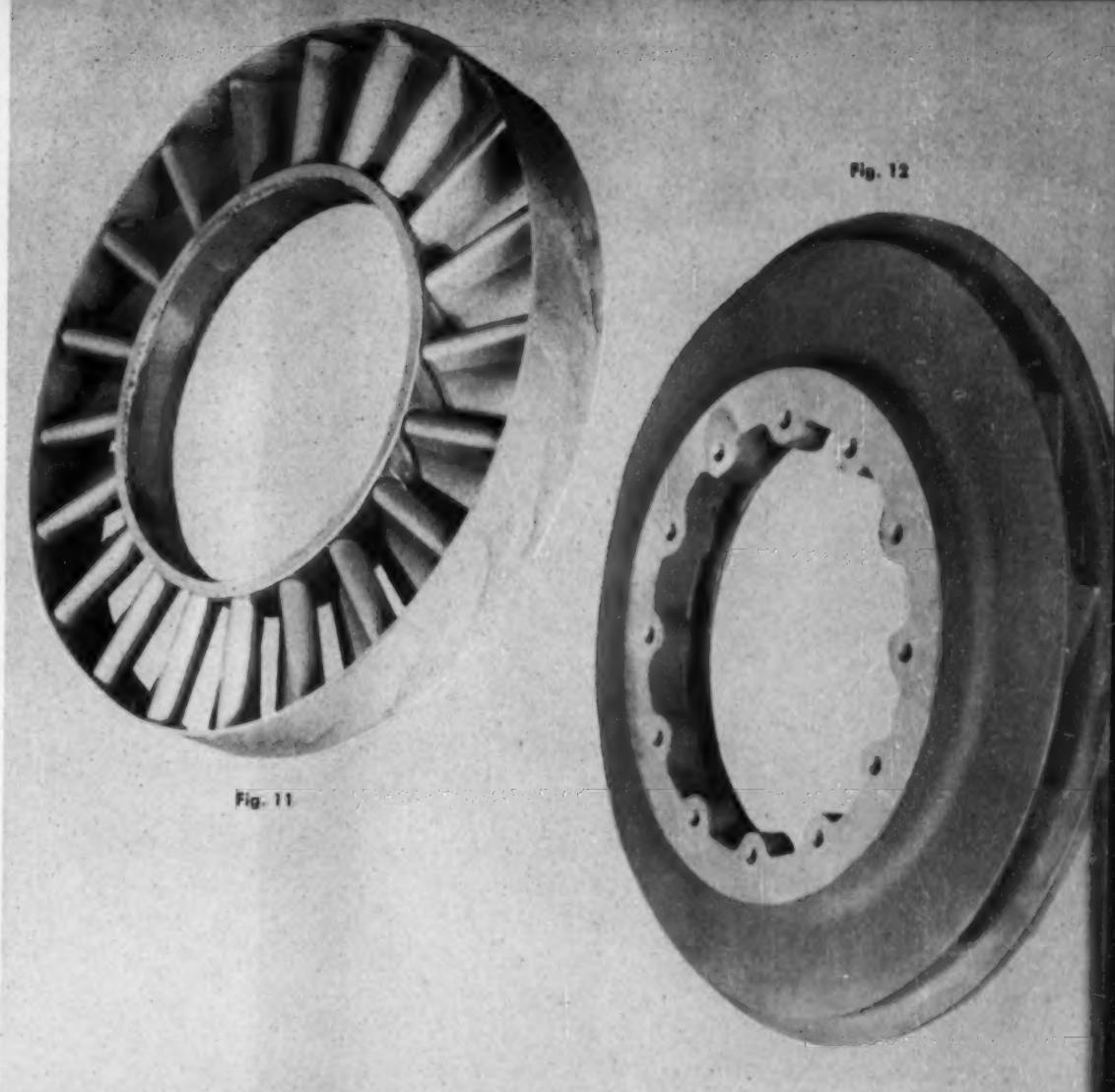


Fig. 11

Fig. 12

As diesel design continues to progress towards lower specific weight per horsepower, greater efficiency and lower cost, the turbosupercharger will become increasingly important. This basically simple engine accessory will eventually find universal application on large and small engines. As produc-

tion requirements increase, the advantages of high-production technique will permit supercharger cost reductions such that even diesels in the 100 horsepower range will be unable, economically, to avoid turbosupercharging. The turbosupercharger is opening big, new fields for diesel development.

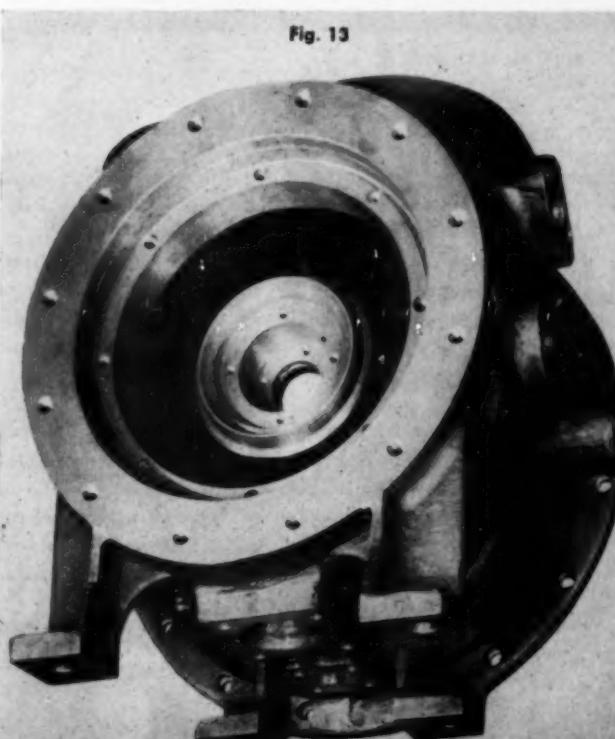
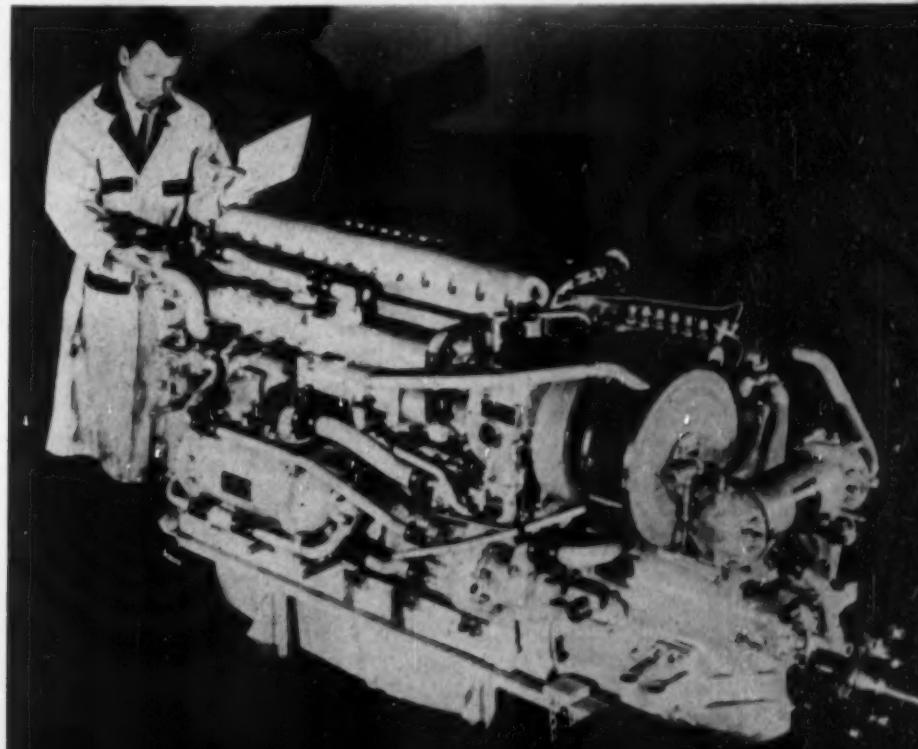
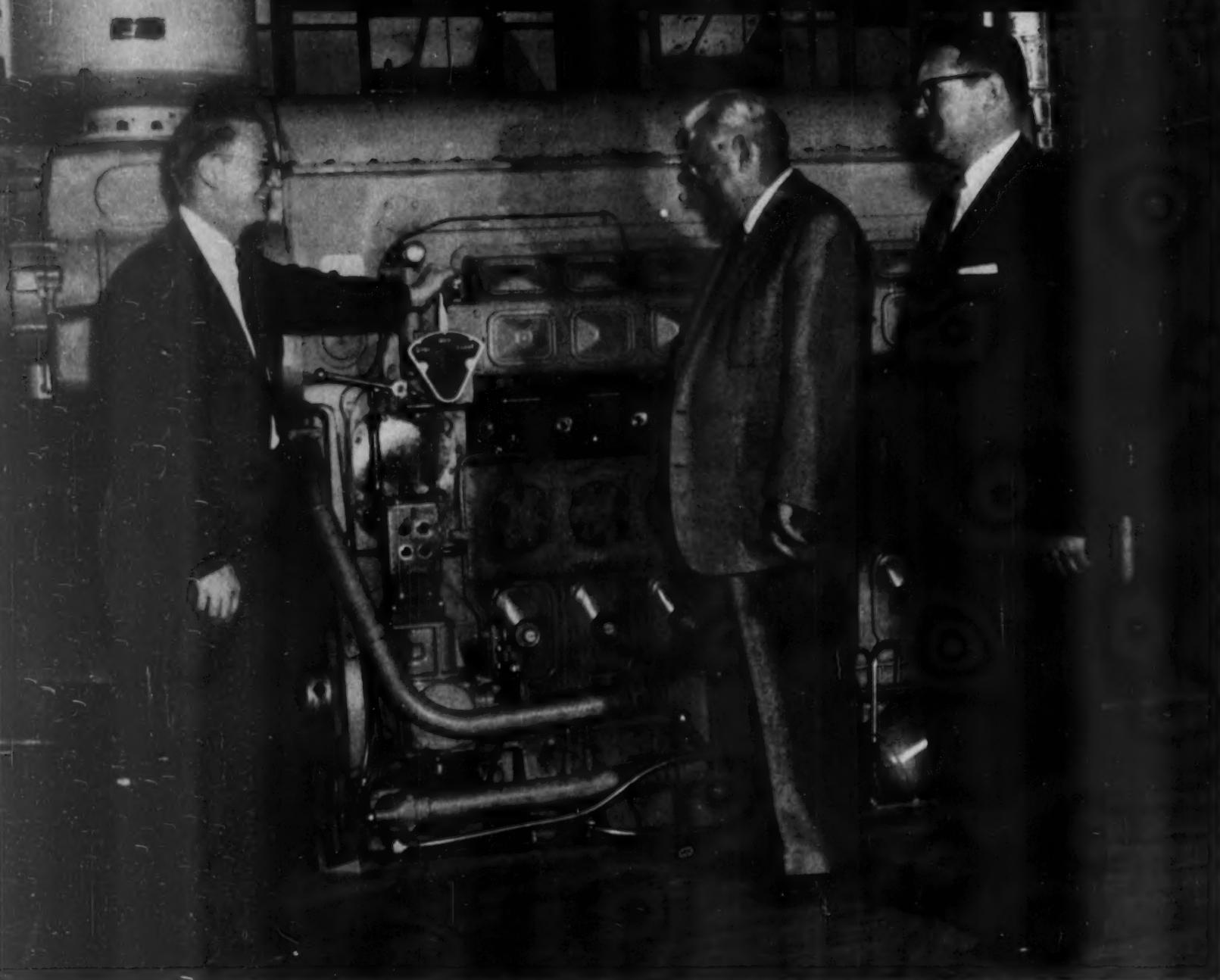


Fig. 13



I WENT UP TO BELOIT LAST MONDAY TO SEE A NEW DIESEL

BY REX W. WADMAN



Robert H. Morse, III, manager of this big plant at Beloit—Rex W. Wadman and Carroll E. Dietle, Fairbanks-Morse Manager of Diesel Sales, up from Chicago.

BELOIT, Wis., April 20. It has been quite awhile since I've visited the Fairbanks Morse engine plant at Beloit, so I came up here today from Chicago. I have heard some interesting things about a small edition of the model 38 opposed piston engine. I wanted to see it in its nursery so-to-speak, to talk with its parents and I did all that and more. I'm glad I made the trip.

Sure enough, the new child is getting ready to walk. It talks now. The table at the end of this article gives you the vital statistics. Volume 18 of the DIESEL ENGINE CATALOG (available June 15th) will bring you full technical details. I'm just going to give you my impressions of the high lights

of the unit—why I think it's the most important development of the year in a new medium power range, medium speed range engine.

The first thing to catch my eye was the engine frame, an all-welded job, clean cut, strong and compact. The stress members and walls of the block are made of mild steel. Plenty of material is used to obtain maximum possible stiffness for good bearing alignment and to reduce vibration. To further increase stiffness, the air receiver including blower ducts, has been made a part of this block. The main bearing saddles are securely welded to the vertical stress members, forming continuous stress plates. The lower block contains a space for the exhaust

manifolds on either side of the engine. The manifolds as well as the exhaust passages leading from the cylinders to them, are surrounded by cooling water. To protect this water cooled portion from corrosion, this entire space is coated with Herculite before assembly of the removable manifolds. The finished block weldment is then subjected to a rigid magnaflux test for fabricating crack

The next thing to catch my eye was the all aluminum bearings. I find F-M have been using all aluminum bearings in their production engines, including all their railroad jobs, since 1949. So, it's no new thing here at Beloit, but it was a bit new to me, so I went into the matter at some length. A

solid single material bearing shell provides protection to the expensive crankshaft in case of a bearing failure as against bearings of the bonded type—less chance of serious scoring, so the engineers here told me.

The aluminum material reduces the rotating weight markedly when applied to connecting rod bearings, thus providing an additional safety factor to the main bearings.

Aluminum bearings being harder than the normal bonded bearings, they perform equally well on either forged or cast iron crankshafts.

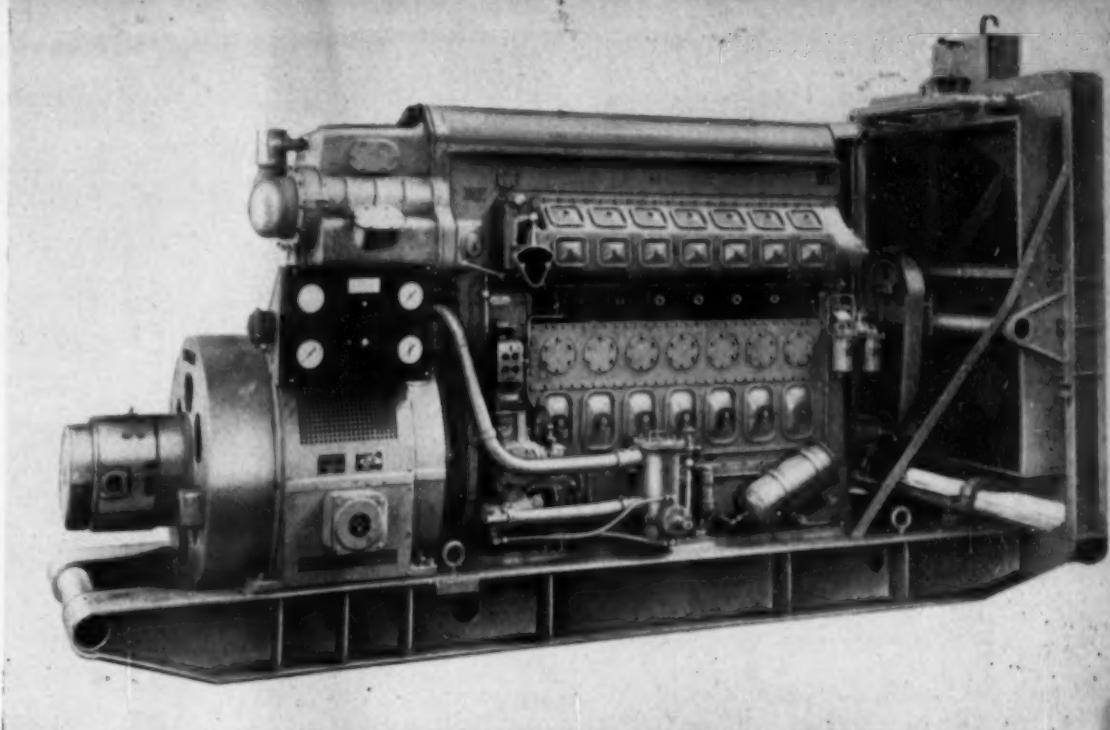
The matter of weight saving is substantial. Take the daddy of all O-P engines here, the 8 1/8 in. x 10 in. machine. The change from conventional white metal steel or bronze backed con rod bearing shell, to the aluminum shell reduced the rotating assembly weight by some eight pounds. The first field installations of these aluminum bearings went into engines rotating at 720 rpm. in 1948, and they are still operating satisfactorily. So you can't blame me for spending some time on bearing design and construction on the small O-P unit here.

Of course, there are equally strong arguments for bonded bearings and more engine companies use them than aluminum bearings, but I wanted you to see what I saw today. What's good for one engine is poison for another. It's interesting to note that Federal Mogul, one of the largest manufacturers of diesel bonded bearings, also makes these all aluminum bearings for Fairbanks Morse.

Then we got to the engine itself and I was impressed with the degree of completeness its designers had carried the matter of integrating the accessories into the engine. More accessories are engine driven and engine mounted, and they are collected together at one end, so as to allow the other end free for power take-offs; clutches; torque converters; marine gears, etc. (the engine is non-reversible). It will be noticed in the illustrations that the water and lube pumps are integrally mounted and driven from the flywheel end as is the Woodward governor and the Roper fuel pump.

The Ross heat exchangers for both lube and water are built into the engine. In each case a Verna-Therm thermostat control is installed on each line, rigidly controlling the temperature at which these valves permit free flow of either water or oil to the heat exchangers. Detroit Controls, Inc. make the Verna-Therm insides, F-M make the cases. Full flow lubrication is provided with ample size Air Maze filters and duplex Purolators handle the fuel line.

The scavenging blower on this engine is a new development. The principal features are rubber faced housing end plates and wear strips on the O.D. of the three lobe rotors. This permits very small clearances and results in better volumetric as well as adiabatic efficiencies, thereby reducing the scavenging load. Besides increasing the fuel economy of the engine, it also tends to reduce the metal to metal contact of the lobes with the housing and end plates. The rotors run on ball bearings. The scavenging air is discharged into the air receiver at a

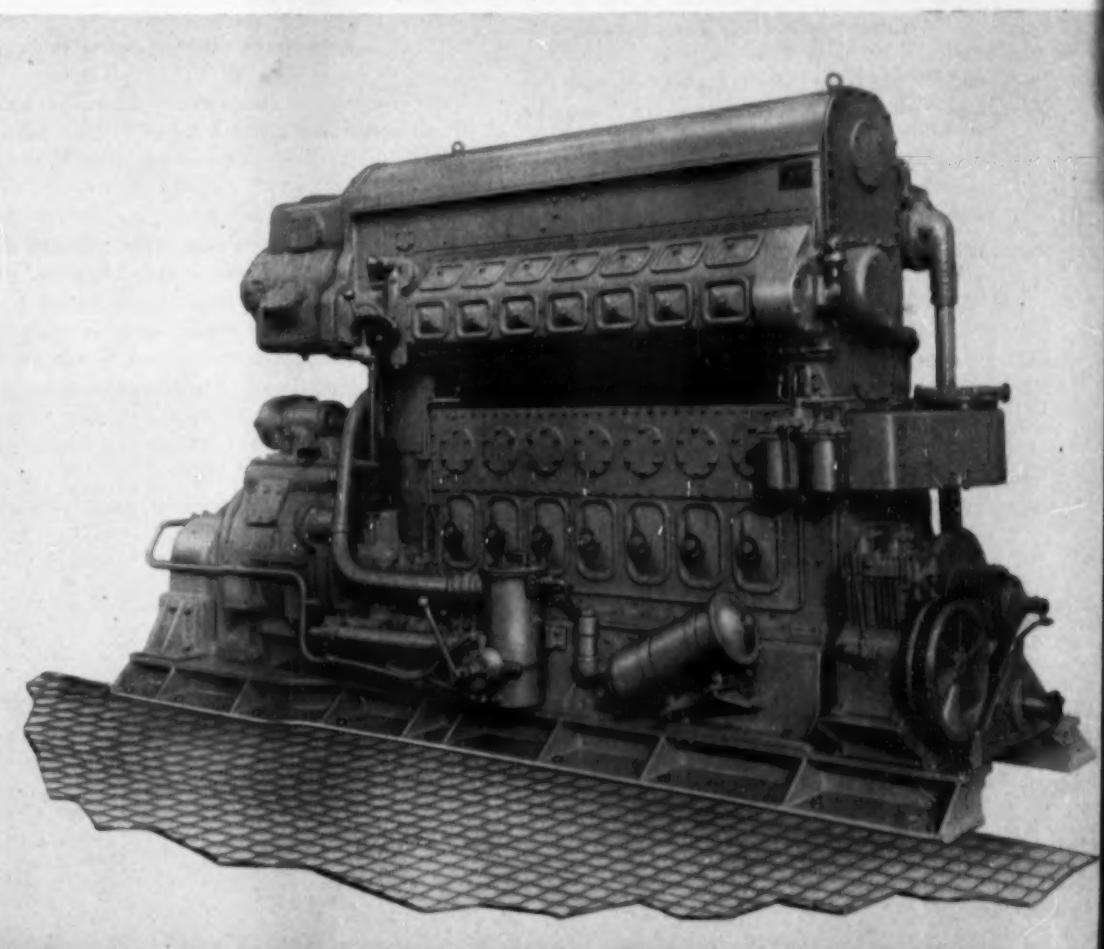


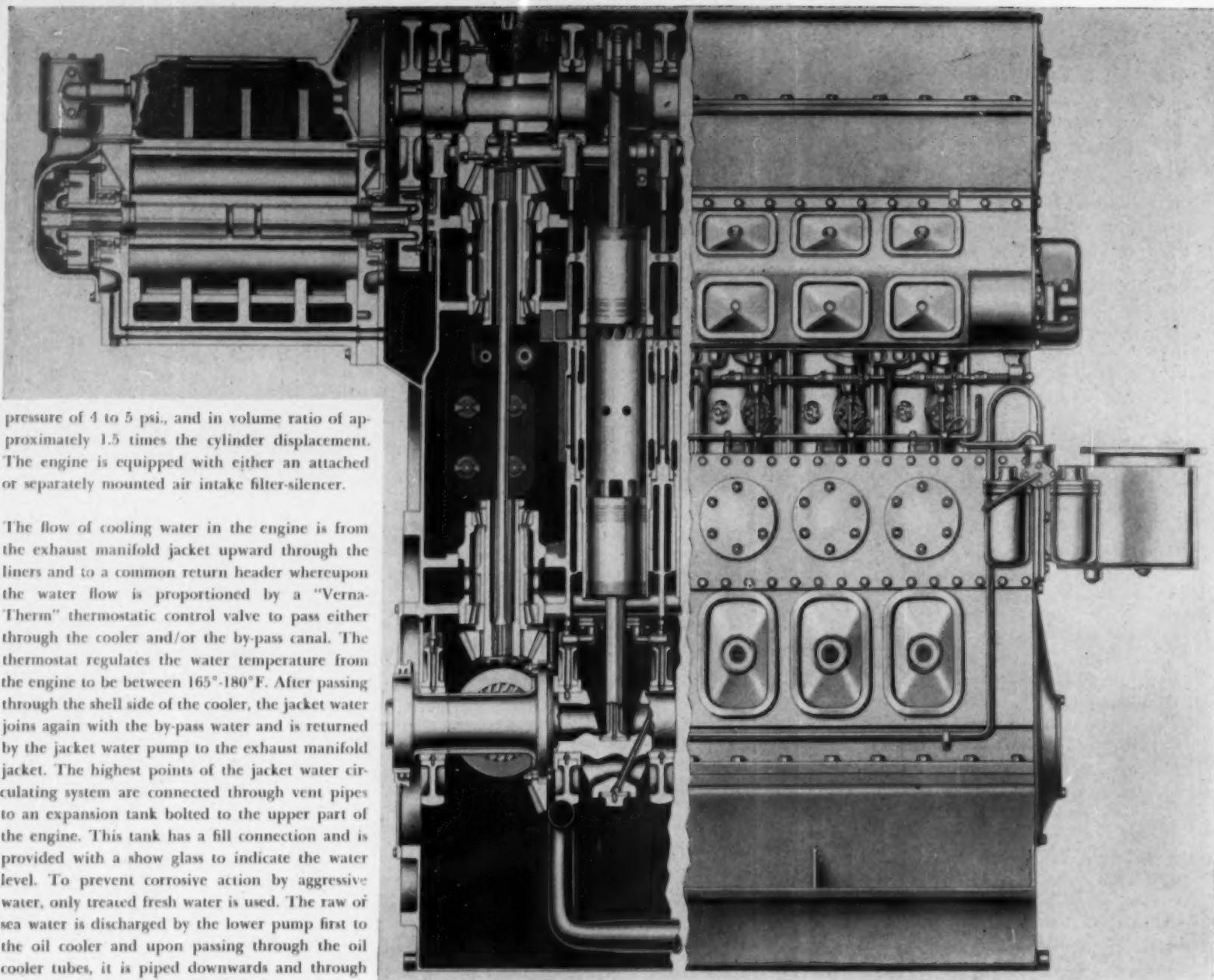
Skid-mounted 7-cylinder opposed piston Fairbanks-Morse new unit showing Yates-American radiator, Purolator fuel filters, Air-Maze lube filter, Woodward governor, Alnor pyrometer and Fairbanks-Morse alternator.

Power Ratings for the New Engine

Model	Cycle	BXS	No. Cylinders	Marine		Stationary	
				RPM.	BHP.	RPM.	BHP.
	2	5 1/4 x 7 1/4	3	1200	225	600-1200	113-248
	2	5 1/4 x 7 1/4	4	1200	300	600-1200	150-330
38F5 1/4	2	5 1/4 x 7 1/4	5	1200	375	600-1200	188-413
and	2	5 1/4 x 7 1/4	6	1200	450	600-1200	225-495
38FD5 1/4	2	5 1/4 x 7 1/4	7	1200	525	600-1200	263-578
	2	5 1/4 x 7 1/4	8	1200	600	600-1200	300-660
	2	5 1/4 x 7 1/4	10	1200	750	600-1200	375-825

Marine version of the 7-cylinder 5 1/4 by 7 1/4 O. P. Fairbanks-Morse diesel with Quincy air compressor integrally mounted.

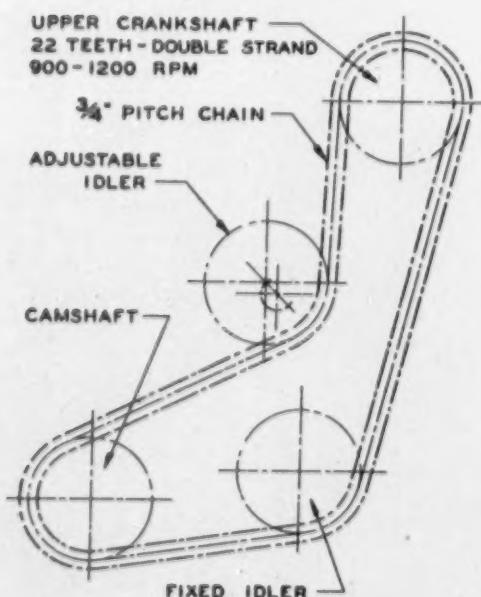




pressure of 4 to 5 psi., and in volume ratio of approximately 1.5 times the cylinder displacement. The engine is equipped with either an attached or separately mounted air intake filter-silencer.

The flow of cooling water in the engine is from the exhaust manifold jacket upward through the liners and to a common return header whereupon the water flow is proportioned by a "Verna-Therm" thermostatic control valve to pass either through the cooler and/or the by-pass canal. The thermostat regulates the water temperature from the engine to be between 165°-180°F. After passing through the shell side of the cooler, the jacket water joins again with the by-pass water and is returned by the jacket water pump to the exhaust manifold jacket. The highest points of the jacket water circulating system are connected through vent pipes to an expansion tank bolted to the upper part of the engine. This tank has a fill connection and is provided with a show glass to indicate the water level. To prevent corrosive action by aggressive water, only treated fresh water is used. The raw of sea water is discharged by the lower pump first to the oil cooler and upon passing through the oil cooler tubes, it is piped downwards and through the fresh water cooler tubes. The piping from the outlet of the fresh water cooler to overboard includes a throttling valve to prevent too high a velocity through the cooler tubes. This throttling

Diamond Chain camshaft drive for the new engine.



Longitudinal section of the new Fairbanks-Morse O. P. diesel rated at 75 hp. per cylinder.

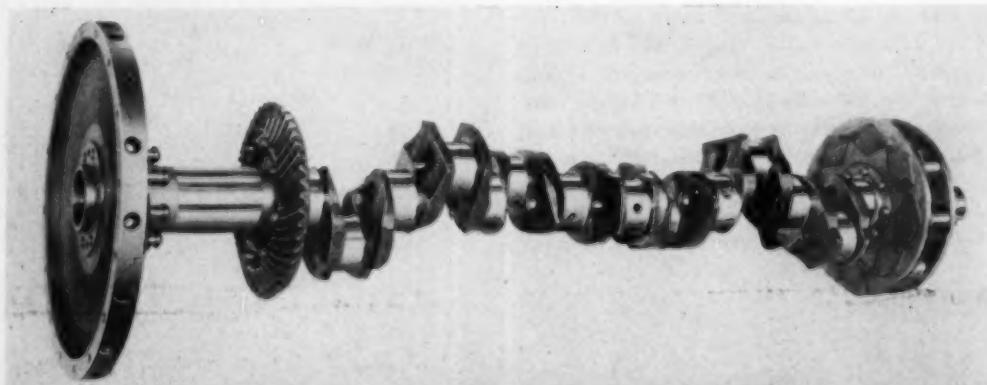
valve is adjusted to obtain a raw water temperature rise through the coolers at 20°-30°F. The coolers are designed for a maximum raw water temperature of 100°.

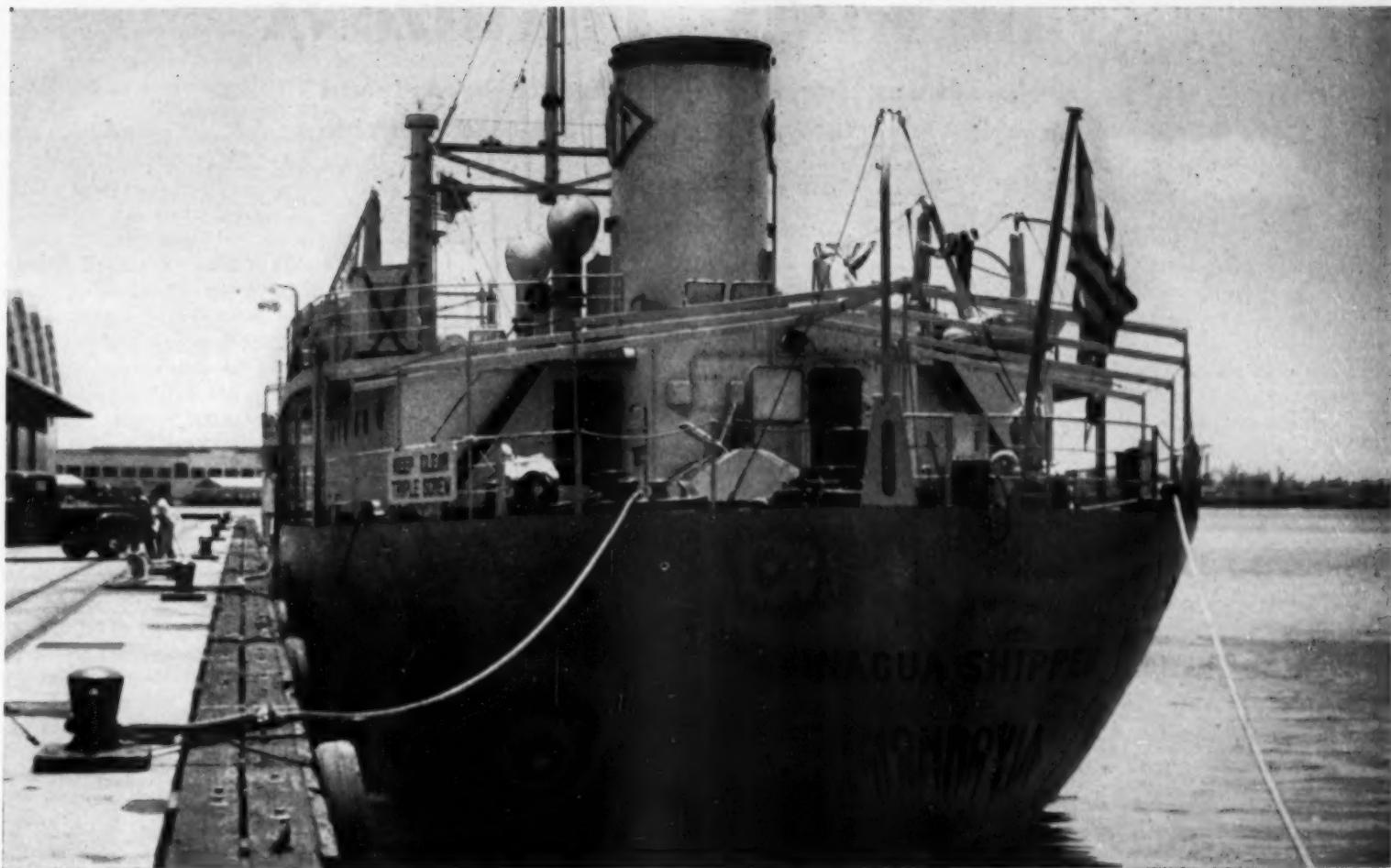
Fuel oil from the supply tank is discharged by the engine driven Roper fuel supply pump to the Purolator duplex fuel supply filter. In the line to the filter is located a relief valve which opens at 40 psi. to return fuel to the tank in case filters are not being cleaned. The fuel cleaned by the filters is passed thru all Bosch injection pumps and is returned by way of a relief valve to the

supply tank. This relief valve is set to maintain a pressure of 20 psi. at the pumps to insure proper filling of the injection pumps. The quantity of fuel pumped is several times in excess of the quantity required by the engine to insure flushing out of all air in the system so that the engine will start quickly.

And so this brings you the highlights of a new small opposed piston engine, rated at 75 hp. per cylinder for continuous duty, built in 3, 4, 5, 6, 7, 8 and 10 cylinder modifications, weighing approximately 20 lbs. per hp.

Crankshaft of the 7-cylinder O. P. Fairbanks-Morse diesel showing the vibration damper on the after end.





Stern view of the *Inagua Shipper*, dieselized tanker constructed in Japan, under Monrovia (Africa) registry and serving in the West Indies.

THE "INAGUA SHIPPER"

By PAUL BEAM

PLOWING its way through the green-blue waters of the Caribbean, the compact tanker *Inagua Shipper*, powered by three diesel Caterpillar main engines, is leaving an impressive list of records in its wake. Nicknamed the "United Nations" ship, the tanker was built by Uraga Dock Company in Uraga, Japan. Owner is West Indies Tankers, Inc., and the registry is under the Monrovia, Liberia flag, giving it a definitely international flavor. When the *Inagua Shipper* was completed recently after a time of only eight months from signing of

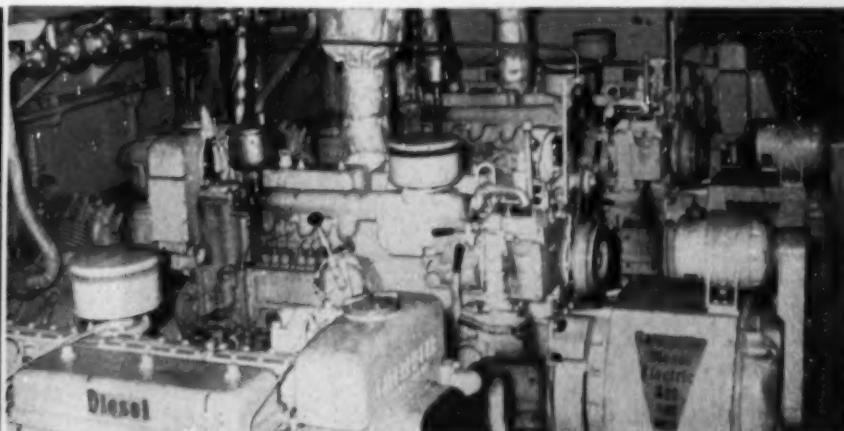
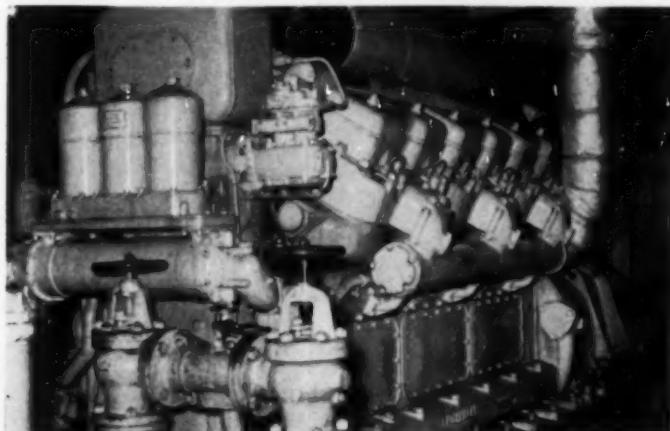
the contract to its completion, international attention was called to the rapidly growing and post-war expanding Japanese ship-building industry.

Powered by three main Caterpillar diesel engines which turn three 5 ft. 9 in. propellers at 300 rpm., the *Inagua* made a steady 11.93 knots fully loaded on its trial run. In addition to the 400 hp. main engines, the tanker carries four auxiliary engines, all Caterpillar diesels. Cost of each main engine

was approximately \$25,000. After crossing several thousand miles of Pacific ocean on the first leg of the maiden voyage, ships' officials said in Honolulu that the big diesels purred along "as gentle as a kitten." Auxiliary engines, vitally important in a tanker for pumping power, operated equally satisfactorily. For the statistically-minded, the *Inagua Shipper* is 280 ft. length overall; 42 ft. in the beam; 14 ft. 6 in. draft loaded; 17 ft. moulded depth; a dead weight of 2100 tons; and a gross live weight of 1819 tons.

One of the three main engines of the *Inagua Shipper*. They are 400 hp. Caterpillar diesels sent from the U. S. to Japan for installation.

This bank of Caterpillar engines furnishes auxiliary power for the vessel. Generators, condensers, pumps, all are powered by the four standard design diesels.



STRIP MINING IN ARIZONA

Strip Mining for Strategic Metals in Arizona Submits Diesels to Extremely Rugged Service

By F. HAL HIGGINS

ARIZONA mining today is breaking new frontiers in mechanization of a romantic industry by the introduction of mobile diesels. Hundreds of millions of dollars have been poured into the copper mines of the state, which produces zinc, lead, gold and silver as important by-products to the all-important and overshadowing metal for which Arizona is famed. As a result, nearly half of the U.S.A. copper production is being taken out in this one state and it is the high speed diesel engine powering the biggest, fastest trucks yet developed that makes possible the mining of low grade ores that have never been economically mined heretofore. To get the story of this revolution in mining of strategic metals that enables this nation to declare its independence of foreign and/or unfriendly areas that have been able to threaten the existence of this nation in wartime, the writer has recently made two trips to Arizona to see and gather the facts.

Around Phoenix, capital of the state and the strip mining copper world are located the hottest and ruggedest proving grounds for the diesel engines that power the tractors, motor trucks, drills, pumps, shovels, compressors, etc. The three biggest diesel engine builders of the world—General Motors, Caterpillar and International Harvester Co. have big investments in permanent proving grounds and plants. In addition, most other U.S. diesels get their trials in the same areas on rented premises where climate, soils and terrain gives them the works to

find out how much they can take before being put up on the markets for heavy construction, logging, farming, road building, pipe line building, etc.

Massey-Harris, Oliver, Continental, Hercules, Buda, White, Waukesha, Cummins, Mack, P. & H., Fairbanks, Morse in various tractors, trucks and other mobile or stationary equipment is proved here. Like General Patton's army that trained in the desert stretches of western Arizona and southeastern California, if it can stand up to this desert heat and sand, it can stand anything anywhere, as Patton proved in Africa in World War II. But the Arizona desert test for equipment goes way back to the pioneer days, of course, when "steam wagons" to haul ore, freight and passengers were tried as early as 1860. This area has been the test of men and their transportation power for more than 90 years. The auto industry thinks it gives its cars a severe test by rolling across desert and mountain roads in Arizona before offering new models to the general public.

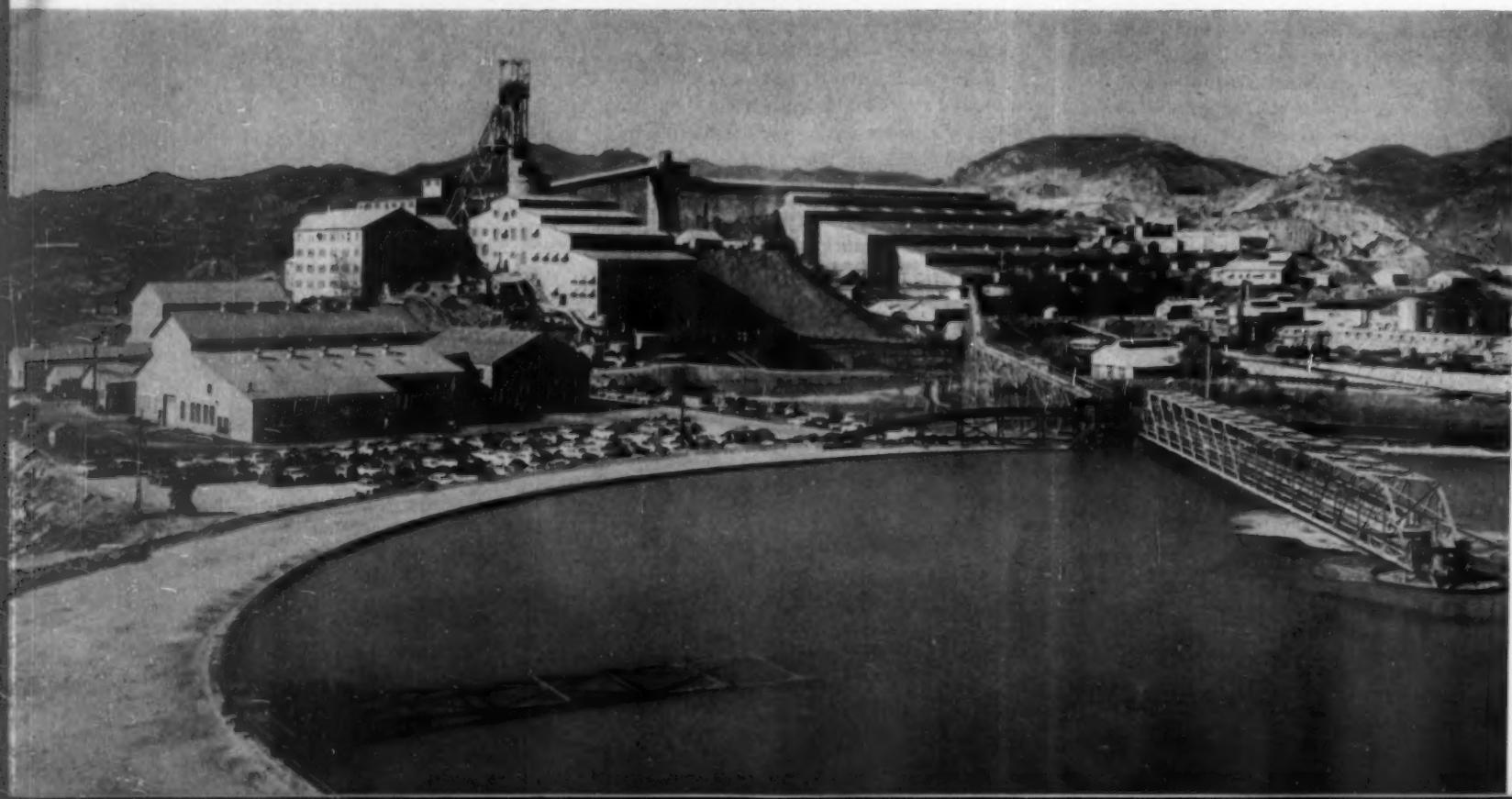
Over at the state capitol in the heart of Phoenix, the writer started with Department of Mineral Resources, State of Arizona, for a talk with director R. I. C. Manning. Manning readily agreed that the diesel engine in the big fast trucks for moving overburden and ore had made possible the economic development now taking place to lift mining to the No. 1 industry that supports much of this state's economy and permits mine labor to be the

highest paid class of labor in Arizona. Average wage payments for 1951 in Arizona were \$2938 in trade, \$3474.12 in manufacturing, 4248.40 in construction, and \$4316.00 in mining. And mining was the one field of labor that showed a declining number of people so employed, indicating the trend to equip and manage the skilled labor force for higher production per man. Said Frank J. Tuck of the Department of Mineral Resources:

"This decline is not due to decrease in mineral output but rather is due to the increased mechanization in mining. About nine-tenths of all mining in Arizona is copper mining. At the present time most of the large copper mines are of the open-pit type which requires more machinery but fewer workmen than underground mining. The ores now being worked do not have as high an average copper content as was the case in former years, but technological improvements in mining and metallurgy have managed to make possible the use of less rich ores."

Here Mr. Tuck gave a table of copper prices and percent of copper in the ores mined over a period of 42 years from 1910 to 1951 to show the hazards of prices in the mining of copper as the industry had encountered it in this stretch of history. Prices started at 12.7 cents per pound in 1910, went up to 27.3 in World War I, slid off to 6.3 and 6.4 cents in 1932 and 1933, rose to 16.2 in 1946 at end of World War II, and then lifted to the present era

A view of the Miami plant, one of the several big Arizona copper reduction installations. The large pool in the foreground plays a part in the "leaching" process, a chemical action to process the ore.



of government encouragement from 1947 to 1951 at 19 to 24.3 cents. During all these years, the ore was getting leaner in copper as it left 1910 at 4.07% and dropped below 2% in 1920 to hit a low of 1.43% in 1930, then rose to 6.36 in 1933 when most of the mines were down. But from that small production of a rich ore, the percentage of copper slid steadily downward year by year to .89% in 1945. From then to 1951 it was in the .90's, lifting above 1% with 1.07 in 1950, and then down again to .97 in 1951.

While only 6% of Arizona's labor force was at work in mining, mining payrolls amounted to 15% of the total wages in covered employment. The value of the 1950 production in five chief minerals for the state was over \$200,000,000, or practically the same as for farm crops and live stock the same year. But as sidelines, by-products of copper mining, many other strategic and important peace time metals and non-metallics play an important part in the state economy. Lead and zinc have risen as sidelines to the copper strip, or open-pit, mining. Manganese, molybdenum, asbestos, barite, lime, gypsum and perlite are some of importance in spite of being dwarfed by the big king of Arizona metals —Copper.

Whole towns and cities are literally built by and on the mines: Douglas, named for the famed Scotch family that produced a cabinet member and ambassador to Great Britain, is the leader with nearly 10,000 population; Morenci, Globe, Ajo, Miami, Superior, Bisbee, Ray-Sonora, Warren, Clarkdale, Hayden, Jerome, Lowell, Tombstone of OK Corral battle fame that brought the Earp-Clanton feuding to a blazing finish, Patagonia and Winkelman.

The writer followed his interview with the State Department of Mineral Resources staff by visiting six of these areas in the company of diesel factory chief engineers and dealers who are continually on the jump to develop, install and service their latest diesel equipment to keep the Arizona strip mining industry not only rolling but adding to its crawling and rolling equipment to increase the efficiency of the mines already equipped with their latest products and meet the advances made by their competitors. This Arizona copper mining as seen today, nearly seven years after the end of World War II, is the most rugged free enterprise competitive battle the writer has seen in his 40 years of observing the mechanization of U.S. and Canadian industry.

From the top management down, the Arizona mines are manned with teams of skilled and experienced men who are doing a top flight job for nation, state and companies whose capital, brains and daring have gone into mining. They have advanced so far from the old pick-and-shovel desert rat stage of the traditional gold hunter that it seems safe to state that barring a Government let-down in developing the industry as a national essential to peace and defense for future wars, the great mountain areas of the West will soon yield practically all the metal needed for any and all demands. But the importance of prices to keep the mines on a profitable and expanding basis is fundamental to a sound metals backbone for Uncle Sam.



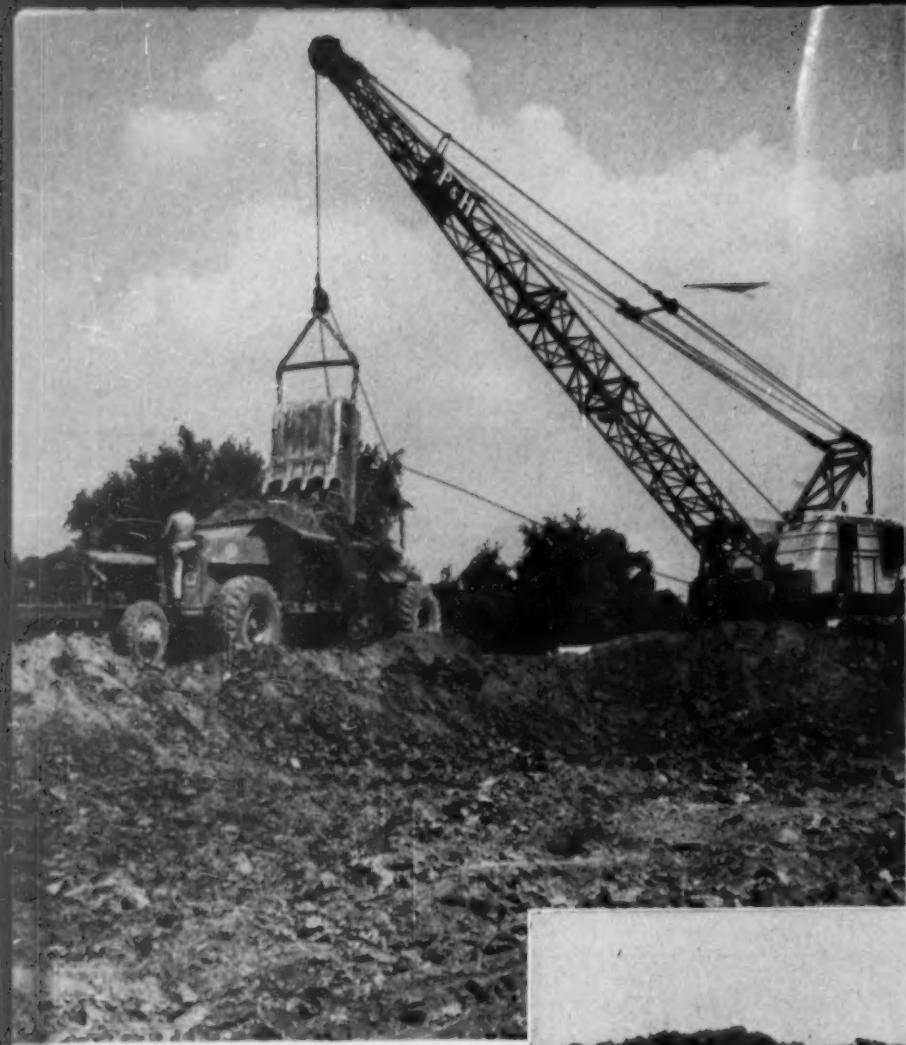
A line-up of diesel trucks over a holiday. This mine is giving all the diesels a chance; Hercules, Buda, Cummins, GM and Caterpillar.

An International TD-24 and carry scraper moving overburden for McCarrell and Grimes at their 1700 acre leased mine near Sanders, Arizona.



The Castle Dome open-pit mine is a picturesque series of ups and downs over which diesel trucks roll at 18 to 30 miles per hour moving the overburden.



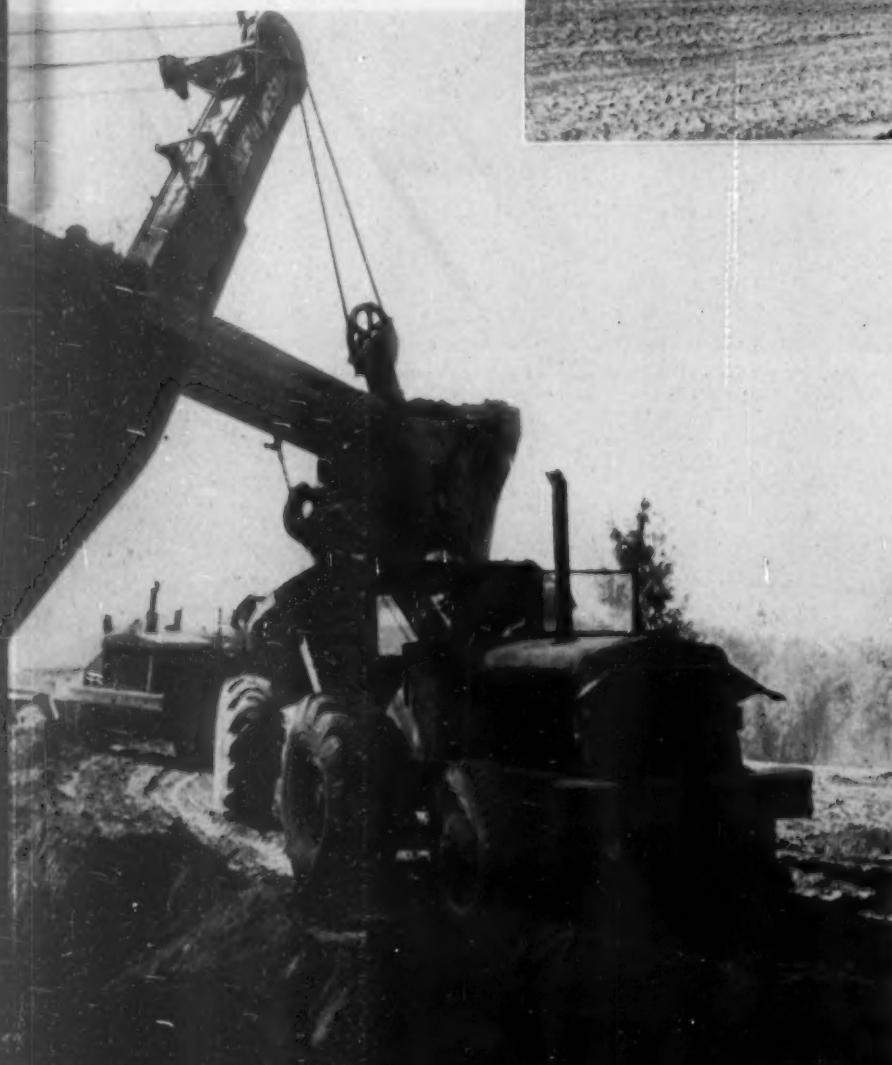


Top: Loading 13 yd. bottom-dump on New York Thruway near Liverpool, N. Y. *Right:* Dougherty fleet of Euclid scrapers at work near East Pembroke. *Bottom:* Loading a 13 cu. yd. bottom-dump near Albany, N. Y.



Top: White Oaks Excavators' 15 ton rear-dump Euclid working near Schenectady building a spur to the Thruway.

Bottom: On the New York Thruway near Verona is this 13 cu. yd. bottom-dump Euclid.



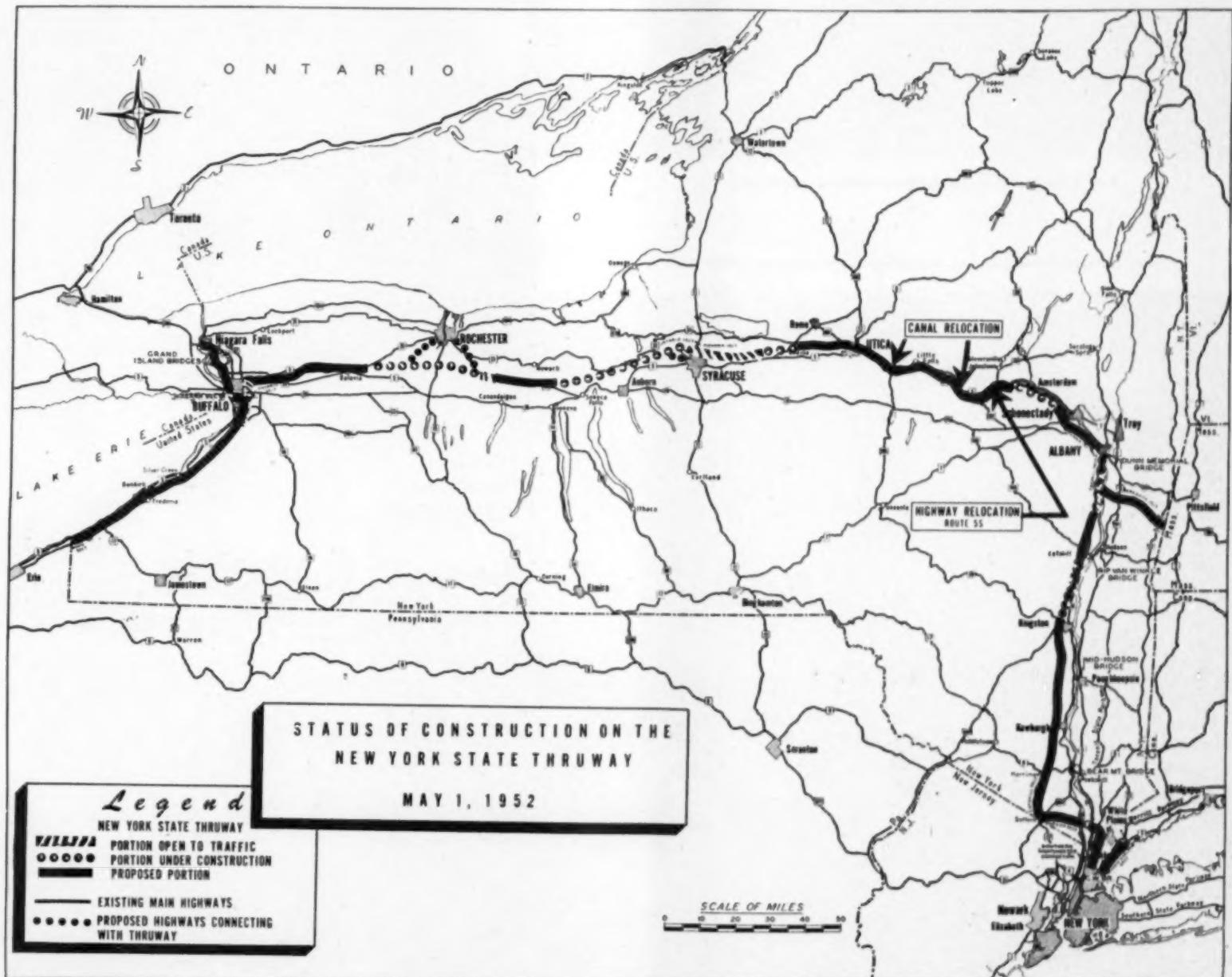
DYKES HELP BUILD NEW YORK THRUWAY ACROSS MONTEZUMA SWAMP

THE longest and most modern thruway is due for completion in about two years. This New York State project will be 535 miles long and have four lanes 80% of its length. The remainder will be six lanes. Traffic will be separated by grass 20 to 150 feet wide and the maximum grade will be 3%. There will be 525 bridges and grade separations. This construction job will necessitate the excavation of 80 million cu. yds. of dirt and rock. One of the most interesting and difficult sections of the half billion dollar, 535 mile New York Thruway cuts across the famous Montezuma swamp and wildlife sanctuary near Auburn, New York. There 2½ miles of a 6½ mile stretch is swamp land that has had to be mucked out to a depth of 9 feet and

refilled with new material. Some parts are open water from two to three feet deep. In addition about half of a total of 1,500,000 yards of fill required had to be obtained by crossing a navigable stream, the Seneca River, if a haul of better than four miles was to be avoided. The contractor, A. S. Wikstrom, Inc., of Skineateles, New York, is employing unusual techniques in working this job and has about 300,000 yards of fill remaining to complete his work.

The long haul was eliminated by spanning the river with a 220 foot timber bridge some 30 feet high to permit navigation. Approach fills of approximately 400 feet in length had to be made.

The structure, a one lane bridge, reduced the hauls from borrow pits to a maximum of approximately one mile. To muck out the swamp sections, Wikstrom first built two parallel dykes separating and confining the actual roadway from the rest of the swamp. Euclid 13 yd. bottom-dumps were used for hauling and bulldozers used for pushing the fill into the water in extending the dykes. According to Fred Johnson, Wikstrom's general superintendent, the distribution of payload weight on widely spaced axles of the hauling units made it possible for them to work on new fill areas without difficulty. After the dykes were completed, shovels and draglines were placed on them to muck out the roadbed. Following this the fill was made.





Euclid loader and 15 cu. yd. bottom-dump near Montezuma.



15.5 cu. yd. scraper owned by A. L. Dougherty caught near East Pembroke.

A fleet of Cummins and GM powered 18 yd. Euclid bottom-dumps, working with a Euclid loader, are being used. Although Johnson believes that a two-lane bridge would have been justified to speed operations, some 900 loads in a 20 hour day are being hauled across the bridge, or a load every 1½ minutes. Empty returning units increase the traffic on the bridge, requiring traffic lights at night. Production is approximately 13,600 loose yards a day or 680 yards an hour. A fleet of twelve "Eucs" is working with the loader and six additional new units have worked six months without any trouble according to Johnson. Euclid reports that better than 135 "Eucs" are presently working on the approximately 160 miles of thruway under construction at this time. They are being used by 19 con-

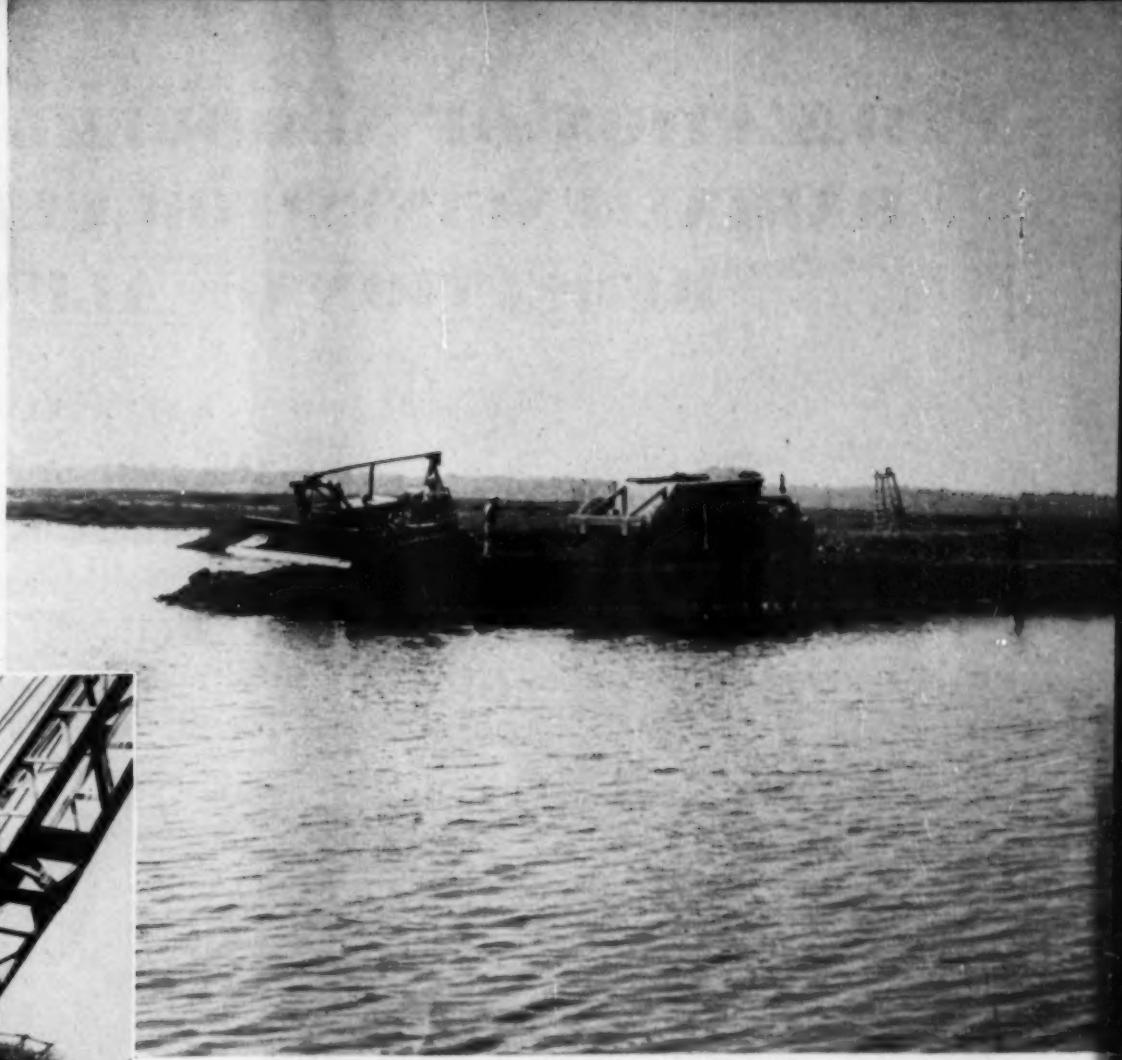
Another view on the spur to the New York Thruway near Schenectady. A



tractors. Seven dieselized Euclid loaders and twelve 15.5 cu. yd. scrapers are included.

Moving big yardage on another section of the New York Thruway project, the A. L. Dougherty Co. of Indianapolis has averaged 300,000 cubic yards a month. In the two months' period from July 20th to September 18th, 600,000 cu. yds. were moved with 15½ yd. Euclid Scrapers. Six "Eucs" were used up until September 1st when three additional units were added. The firm is grading a section approximately 9 miles long, located west of Batavia. A total of 1,800,000 yards are to be placed of which 1,300,000 yards are borrow. Johnson, Drake and Piper Inc. of New York City is the prime contractor.

15 ton rear dump Euclid is shown being loaded.



Dumping on the fill to extend one of the dykes.

View of the Thruway cleared and leveled and ready for the surfacing.



UTILIZATION OF NORDBERG GAS BURNING RADIAL ENGINES FOR ELECTROLYTIC REDUCTION OF ALUMINUM

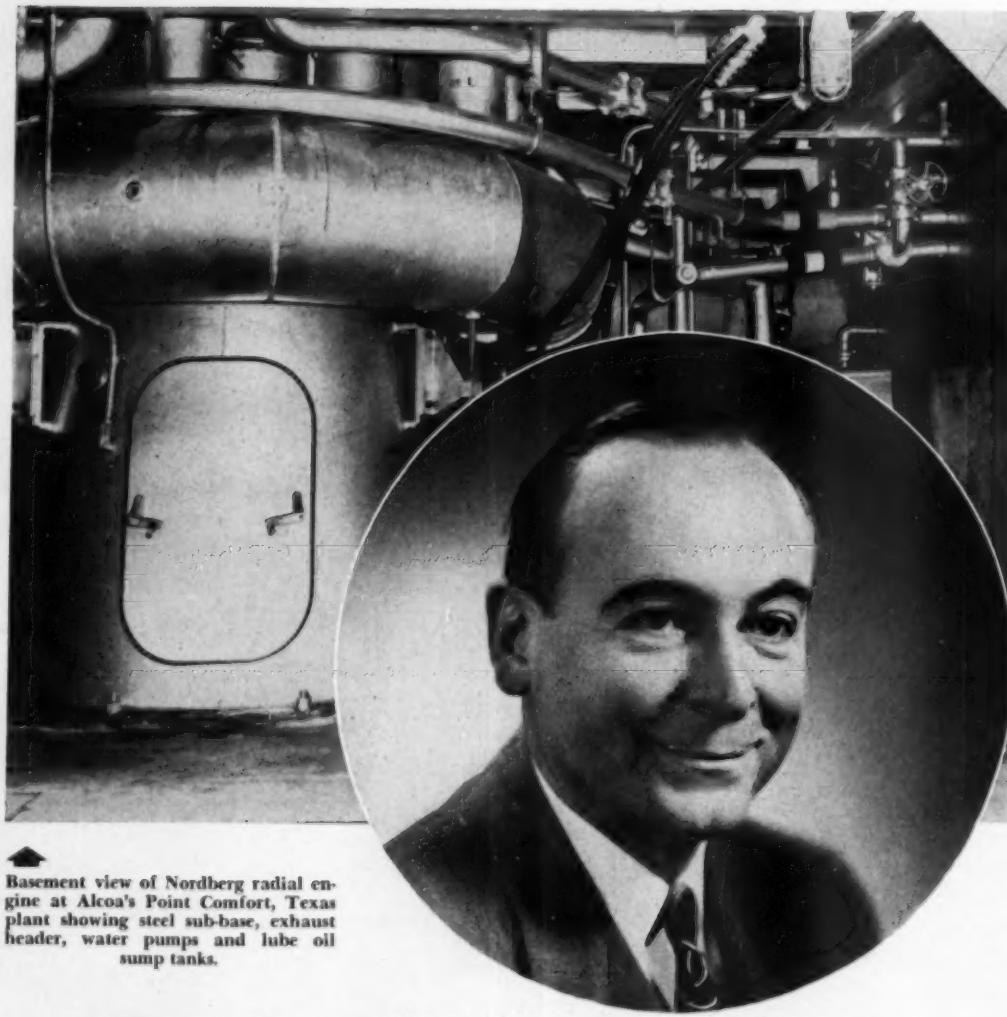
By ROLAND W. BAYERLEIN*

THE growth of the aluminum industry in North America during the past decade is, in truth, nothing short of phenomenal. We are continually encountering large evidences of the application of this strong, lightweight metal and the feeling is generally that the industry has hardly outgrown its infancy. If this is true, and we believe it to be so, then large scale development of aluminum production facilities will continue at a rate characterized by industry's growth during the past several years.

There are two key factors upon which this anticipated growth is principally contingent—the availability of bauxite ores and the power required for the electrolytic reduction of the alumina contained therein. It is believed that the control of, or the access to the important developed and potential reserves of bauxite in the Caribbean area are sufficient to meet the requirements of North American industry for the balance of the Twentieth Century. The power problem is not so readily realized in light of existing facilities. A serious consideration to all companies in or entering the primary aluminum reduction field is the essential requirement of low cost power for profitable operation. These requirements have been successfully met in the past either through utilization of energy from publicly or privately owned power projects or by direct construction of electrical generating facilities by the individual producer. It is significant at this date in the case of the former, that the most existing generating facilities are now overburdened, the rates are not always economically feasible or they are in a locale that does not lend itself to construction of reduction facilities. As a result, there has been a definite trend by producers during the past several years to build and operate their own power generating plants at or near their reduction site.

The current domestic producers of aluminum are typical of this approach. They are Aluminum Company of America, Reynolds Metals Company and Kaiser Aluminum & Chemical Corporation. The Alcoa plant near Port Lavaca, Texas during the past three years has installed approximately 220,000 kilowatts in the form of 194 Nordberg gas-burning radial engine-generator units. With a total of approximately 350,000 horsepower, this is the world's largest internal combustion engine

*Paper given before American Institute of Mining and Metallurgical Engineers, Feb. 11, 1953, Los Angeles.



↑
Basement view of Nordberg radial engine at Alcoa's Point Comfort, Texas plant showing steel sub-base, exhaust header, water pumps and lube oil sump tanks.

The author, Roland W. Bayerlein, Vice President, Heavy Machinery Division, Nordberg Manufacturing Co.

plant. The new Kaiser plant located at Chalmette, Louisiana, currently employs 80 of the Nordberg gas-burning radial units and is now erecting a 350,000 kw steam power plant comprised of 15 Foster-Wheeler boilers and 16 General Electric turbo-generators. At its new San Patricio Reduction Plant near Corpus Christi, Texas, Reynolds Metals has installed 42, 2500 kw Cooper Bessemer turbocharged natural gas engines and 41, 2000 kw General Motors 16 cylinder vertical shaft natural gas engines for a total capacity of 187,000 kw. Reynolds, in addition, also operates its own generating plant at Jones Mill, Arkansas where 18, 2250 kw Nordberg two-cycle gas-burning diesels and 50, 750 kw Cooper Bessemer gas engines provide energy

for aluminum production.

It is significant in many respects that most of the major producers are centralizing their operations in the Gulf Coast area of the United States. Not only are the producers close to necessary water supplies and improved transportation facilities for bauxite ore, but full advantage can be taken of the attractive fuel rates made possible by ready availability of natural gas. The gas-burning radial engine built by Nordberg Manufacturing Company was developed primarily for generating power through use of this fuel and its application for the electrolytic reduction of aluminum is the subject I will discuss.

The Nordberg gas-burning radial engine was introduced in 1950 following extensive research and development work and pilot model testing in co-operation with the Aluminum Company of America. They are built as a two-cycle engine with 11 or 12 cylinders of 14" bore and 16" stroke and develop up to 2125 hp, 1500 kw at 400 rpm. Both engines are designed with port scavenging and port exhaust, the pistons uncovering the ports in the cylinder walls thereby eliminating intake and exhaust valves. The basic advantages of the radial engine design result in a simple, compact, sturdy cylinder arrangement packing much power in small floor space. With these economies in space, building costs can be greatly reduced. Because of its inherent excellent balance and absence of vertical unbalanced forces, a relatively lightweight and inexpensive foundation is required. Because of the simplicity of the foundation requirements and the physical design of this engine the possibility of shaft misalignment, distortion and consequent bearing failures due to any variations in the foundation is eliminated. The 12 cylinder engine is a little over 13 feet in diameter and 7 feet high from the operating floor level. The vertical generator requires a space of about 10 feet from the top of the foundation to the operating floor. The net weight of the complete engine with upper steel base is 79,000 pounds. This weight, coupled with small engine dimensions, permits shipping a completely factory assembled engine to the site, reduces installation time as well as cost. Cylinder heads, pistons, upper and lower bearings as well as several other integral parts are made of aluminum. This engine has very low knuckle and wrist pin bearing loads resulting in practically no wear to these parts and based on experience with this engine at Kaiser and Alcoa the engine will run 20 to 30 years with practically no bearing troubles.

Before discussing some of the engine's salient operational features, let us consider some of the more important design characteristics. Figure 1 shows a closeup of one of 74 twelve cylinder radial engines recently installed as an addition to the 120 radial engines at Alcoa's Point Comfort reduction plant. One of five houses of 40 engines is shown in Figure 2. The engine is installed at floor level with its base and direct connected generator located immediately below it at the basement level. Figure 3 shows the lower steel sub-base, exhaust header, water pumps and lube oil sump tanks in this type of arrangement.

The cross section of the gas-burning radial engine, Figure 4, shows the principal components of the engine. As you see, the engine is installed with the axis of the crankshaft in a vertical plane with the single crank at top. The crankshaft is made of high tensile alloy cast iron. Cylinders, equally spaced radially about the shaft in a horizontal plane, are bolted to the frame. Aluminum pistons are of the trunk type. All connecting rods of steel forgings are identical. This makes this radial engine stand out as entirely different from any other radial engine. The main frame is a single casting with a central hub which houses the lower aluminum crankshaft main bearing bushing and the steel babbit Kingsbury type self-aligning thrust bearing which carries the weight of the crankshaft and

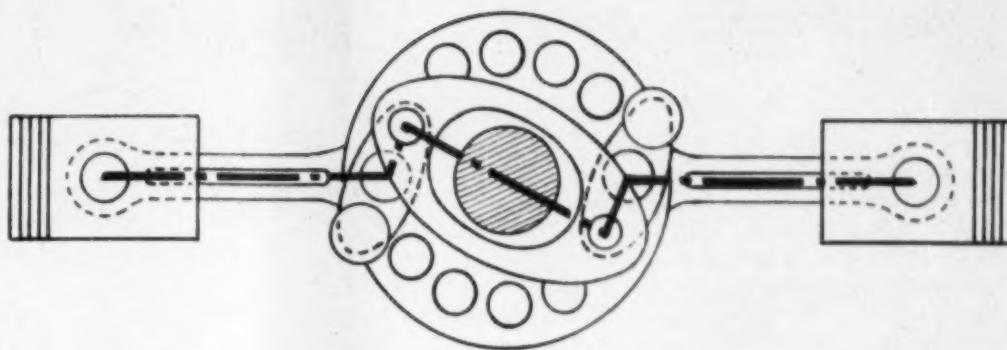


Fig. 5.

RESTRAINING LINKAGE

generator rotor. The upper aluminum crankshaft bearing bushing is located in the cover which is bolted to the frame. Mounted on top of the cover are the governor, distributor and gas valve operating mechanism.

Since the cylinders fire one after another in clockwise rotation, the piston loads are transmitted

to the crankpin at an even sequence with the result that torque variations are small in magnitude. Opposite pistons counteract the peak cylinder pressures and therefore the resulting loads on the crankpin and the two bearings are greatly reduced and of small magnitude. With only two main bearings, the friction is reduced and the mechanical efficiency of the engine is high, approximately 92% without

Fig. 4. Cross-section of Nordberg radial engine.

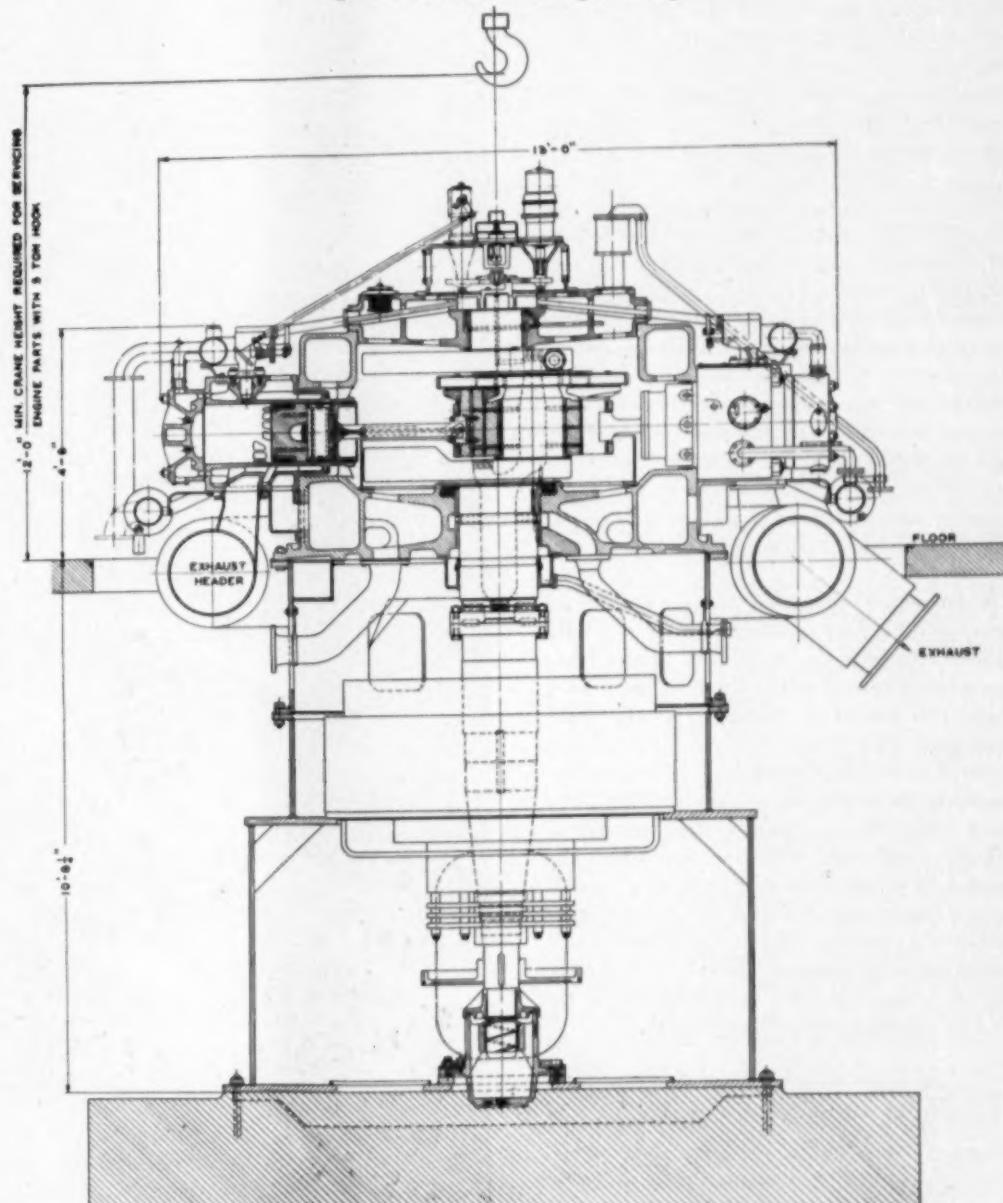


FIG. 4

8065

Fig. 8. Nordberg radial engine on its way to the New Orleans plant of Kaiser Engineers.

auxiliaries. In all radial engines the rotation of the crankpin bearing must be prevented in order to obtain constrained motion of the connecting rod crank end. The Nordberg Company has solved this problem with two patented and equally successful restraining mechanisms. The geared mechanism used in the 11 cylinder engine has been described in various papers before but the restraining linkage used on the 12 cylinder radial engine has not been generally discussed. A diagrammatic representation of this linkage assembly is shown in Figure 5.

The perfect balance of the radial engine is attributable to this design and Figure 6 shows the linkage as installed in the 12 cylinder engine. Balance is achieved by actual convergence of combustion pressures and inertia forces at one focal point on the crankshaft axis. The inner ends of the connecting rod are secured by knuckle pins equally spaced around the master bearing mounted on the crank pin. Reciprocating motion of each piston is translated into rotary motion at the crankshaft through the connecting rods and master bearings. The master bearing is restrained from rotating by this constrained linkage assembly which makes the master bearing gyrate bodily with the crankpin.

This linkage, however, does not in any way restrain the basic crank motion of the engine mechanism. This motion of the master bearing has great practical advantages. Since the center of the master bearing is moving along a circular path, every point on the bearing moves along circles of equal diameters. Therefore, the knuckle pins, which correspond to crankpins in the connecting rod-crank mechanism, describe identical circles thus making the moving parts of every cylinder kinematically identical. As a result, interchangeable parts can be used in all cylinders and the timing of the engine is greatly simplified and identical for all cylinders.

The compression pressure is 275 psig and 650 psi firing pressure. Each cylinder has a gas inlet valve located above the scavenging ports. These valves are actuated by rocker arms and push rods from a single cam located on the upper portion of the crankshaft. They introduce the gas at low pressure about 20# to the cylinders into the path of the incoming scavenging air to assure mixing. Two spark plugs are in a vertical plane and fire at different crank angles before top dead center. The amount of gas delivered to the cylinders is varied in accordance with the load on the engine by means of a metering valve in the gas header and connected to the governor. The volume of scavenging air is also controlled proportionately to the load by throttling on the blower suction.

There are many other elements of design which are worthy of note; however, those which I have

Fig. 2. One of the five houses of 40 engines at Alcoa's Point Comfort, Texas reduction plant.



FIG. 2

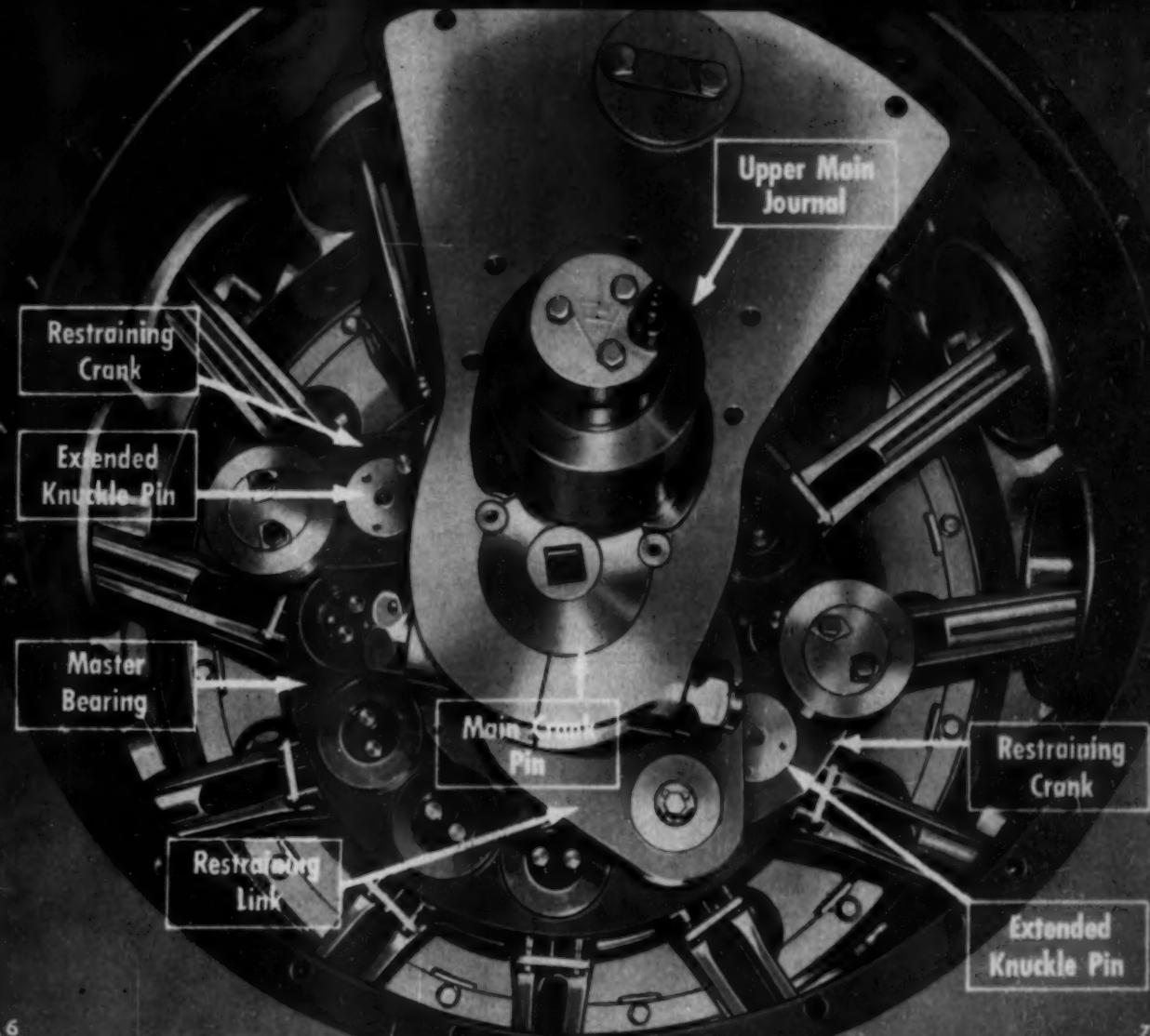


Fig. 6. Shows the linkage as installed in the 12 cylinder engine to which is attributable the perfect balance of this radial engine.

TABLE I Engines and Auxiliary Equipment for One Pot Line

37—NORDBERG Radial Gas Burning Engines, each rated 2125 BHP, 400 RPM, with motor-driven scavenging air blowers and standard equipment.	2—Lubricating oil tanks for clean and dirty oil 2500 gal. capacity each.
37—Generators, 1350 KW, direct current, 400 RPM, 40°C. rise, 667 volts, with Class "A" insulation and motor operated field rheostat. Each generator equipped with slip rings to provide 150 KVA alternating current at 420 volts, 26 cycles, 3 phase to drive engine auxiliaries.	37—Combination jacket water and lubricating oil service pumps, motor driven.
37—Air intake filters.	37—Radiators to cool lubricating oil, jacket water.
37—Exhaust mufflers	1—150 KW gas engine generating set complete with radiator, pumps and control panel for initial starting and emergency service.
37—Exhaust pyrometers.	37—Engine alarm systems.
37—Lubricating oil service pumps, motor driven.	37—Engine control panels.
2—Lubricating oil transfer pumps.	Services of installation engineer and labor for complete erection.
37—Lubricating oil purifiers, full flow type.	Station piping.
2—Lubricating oil centrifuges.	Installed Cost (Engines & Auxiliaries) \$7,126,000.00
	Cost per KW (Engines & Auxiliaries) 142.80

briefly discussed are the more relevant. There was no definite effort to produce a light weight engine, yet the engine's moderate weight, about 37 pounds per brake horsepower, in comparison to other engine types of like duty, is inherent to this radial design.

Previously I mentioned the need of low cost electrical energy as a direct necessity for the electrolytic reduction of aluminum. It is in this field that the

Nordberg radial engine has found its widest application with 274 engines in service. This extensive application can be attributed to the engine's ability to burn natural gas on an economical basis and furnish electrical energy at a cost per kilowatt hour comparable and in some cases lower than hydro or steam generated power. In presenting this and the facts to follow, permit me to state that it is not my purpose to be controversial, but to give an account of the operation of this unique radial engine

TABLE II Building, Foundations and Related Equipment for One Pot Line

37-Ventilating fans for building and generator cooling air, approximately 30,000 CFM each engine, and discharge fans for generator cooling air approximately 13,000 CFM each engine	\$ 95,250	ing scrubbers, filters, meters and valves	14,250
Lubricating oil storage and unloading facilities including two 15,000 gallon storage tanks	5,000	Spur track to plant, trench plates, safety guards, railings and floor plates	20,000
Foundations, including concrete and grouting for engines, generator ventilating ducts, pumps, exhaust mufflers, radiators and other auxiliary equipment—54 cubic yards of concrete per unit estimated at \$40.00 per cubic yard	80,000	Necessary switchgear, cables, conduits, wiring connections, equipment for grounding, feeder panels and transformers and necessary equipment for the electric starting of the engines, installed	635,000
1—Overhead crane, 40 ton capacity with a 5 ton auxiliary	49,500	1—Building to house engines and equipment including preparation of the site for erection of the building. Building dimensions 362' long by 48' wide by 44' high	350,000
Gas piping, outside building, includ-		Building etc. installed	1,249,000
		Total Cost, Complete Plant	\$8,375,000
		Cost per KW, Complete Plant	\$ 168

TABLE III

Labor Cost	1 Pot	2 Pot	3 Pot
	Line	Lines	Lines
Chief Engineer	1	1	1
Assistant Chief Engineer	1	1	1
Lubrication Attendant	1	1	1
Mechanical Engineer	1	1	1
Electrical Engineer	1	1	1
Operating Engineers	4	8	12
Control Room Operators	4	6	8
Engine Attendants	8	16	24
Mechanical Supt.	1	1	1
Maintenance Engineer	1	1	1
Electrical Foreman	1	1	1
Electricians	2	3	4
Mechanics	3	6	10
Pipe Fitters	1	2	3
Helpers	3	7	11
Janitors	1	2	3
Tool Room Attendant	1	1	1
—	—	—	—
Total Salaries Per Month	35	59	84
Total KW Output			
Per Hour	45,900	91,800	137,700
Total Salaries			
(12 Months)	155,700	253,200	351,600*
* (Based on average yearly salary of \$4250 per person.)			
Cost Per Hour	\$17.77	\$28.90	\$40.13
Cost-Mills per KWH (Output)	.3872	.3148	.2914

TABLE IV**Estimated Operating Costs—****Mills Per Kilowatt Hour**

Fuel Cost (10c Gas)	1 Pot	2 Pot	3 Pot
	Line	Lines	Lines
Lube Oil Cost (40c Gal.)	.1332	.1332	.1332
Maintenance Cost	.2690	.2690	.2690
Labor Cost	.3872	.3148	.2914
Miscellaneous Cost	.0042	.0042	.0042
Total Mills/KWH	1.8436	1.7712	1.7478

in aluminum production to the best of my knowledge and ability.

The low initial installation, as well as low operating costs, can best be visualized by analyzing a hypothetical single pot line power plant for a primary aluminum reduction plant. A plant with three such lines would produce about 60,000 tons of aluminum per year. In line with the current methods of production, each potline totalling approximately 45,900 kilowatts would be required. This study then will include all necessary equipment, including building and services, and provision has been made for sufficient standby protection in the form of additional generating facilities. This station would be set up on a unitized basis for required power protection and so that it could be expanded to meet the requirements of two or three potlines or more.

For a plant to serve one potline with these requirements, 37 twelve cylinder gas-burning radial engines are used, each rated 2125 hp and developing 1350 kw dc power and 150 kw of 26 cycle ac power for auxiliaries. On this basis, 34 engines would operate continuously to produce 45,900 kw and three spare engines per potline would be available for standby. This would give a total installed capacity of approximately 50,000 kw. Figure 7 is a section through the engine house of an installation of this type. You will note that all engine auxiliaries are grouped for minimum piping and installation time. The exhaust stack, muffler and heat exchanger are located directly outside each engine. The parasitic power to drive the motor driven scavenging blower, lubrication oil circulating pump, jacket water circulating pump, generator ventilating fan, radiator cooling fan and building ventilating fan, is obtained from the ac slip rings on the generator. Each engine generator set is a self-contained unit.

The estimated cost today of a power house including 37 radial engines complete with dc generators and necessary auxiliary equipment installed would be approximately \$7,126,000 or \$142.80 per kilowatt. A complete list of equipment is shown in

Table 1. In addition to the engines and auxiliary equipment, it would be necessary to supply a building complete with all appurtenances, switchgear, wiring and related items as shown in Table II. It is estimated that this additional cost would be \$1,249,000. Combining the price of the engines, generators, and auxiliaries with the above cost, the overall cost is approximately \$8,375,000 or \$168 per kilowatt.

It has been authoritatively estimated and our experience corroborates the fact that a direct current generating gas engine station can be built for a cost per installed kilowatt which is in the vicinity of the cost of an alternating current steam station using larger individual units. In order to do this, however, simplicity of design both electrically, mechanically and with respect to auxiliaries is a must. Of course it should be kept in mind that to the cost of a steam station must be added the cost of conversion equipment including about 15% spares at a cost of \$60.00/installed kw. One great advantage of gas engines over steam equipment is that the gas engine units are small enough so that the spare capacity may usually be of the order of 10 or 15 per cent. With large steam units, it is often necessary in order to obtain any reasonable economy to use units so large that the spare capacity must be of the order of 33 to 50 per cent. If we assume, therefore, that the cost of the two stations is the same per installed kw, the extra spare capacity for the steam station makes the cost for the steam station considerably greater.

To adequately determine the operating costs of this proposed plant, we will approximate our fuel costs at 10 cents per 1000 cubic feet of gas (1000 Btu. per cu. ft. 1hv.). Based on recent operation of the engines at the Alcoa plant we have a fuel consumption rate of 10,500 Btu./kw., including the parasitic load I mentioned before. This efficiency is in the neighborhood of the best and largest high pressure steam plants. Records likewise indicate that lubricating oil can be purchased in tank car lots for about 40 cents per gallon with lube oil consumption figured at 3000 kilowatt hours per gallon. Maintenance material and parts for major overhaul has been figured at \$1.50 per installed hp per year. This has been termed liberal by Alcoa and we therefore assume it to be adequate. Miscellaneous cost for plant supplies is pro-rated on the basis of \$50 per engine per year which is again somewhat higher than experience indicates. A good yardstick was needed to properly determine labor costs, both operating and maintenance, and Table III is based on the operating personnel found adequate by Alcoa at Point Comfort. This table of labor costs lists personnel required for one, two and three potlines. It is significant to note that the cost per kilowatt hour decreases as additional lines are added. This is true since the addition of another line does not in every case double the personnel required for the original potline.

Table IV shows our estimated direct operating cost to be 1.75 mills per kilowatt hour for a 3 potline plant. Charges for amortization, interest on investment, insurance and taxes would, of course, vary according to the type of accounting procedure used and is not included in the above figure. Let us go

back and discuss the maintenance problems a little more. Experience with this engine in two large aluminum plants, Kaiser's Chalmette plant of 80 engines having been in operation approximately 1 year and Alcoa's 120 engines at Point Comfort operating since 1949 indicates a maintenance schedule as follows: A rather strict preventive maintenance schedule has been found to be most desirable. This program involves the engine and all auxiliary equipment, both electrical and mechanical, associated with the engine. A schedule is setup on a periodical basis and is based on calendar days or engine hours as the case may be. Every 120 days or approximately 3000 hours a superficial inspection of the engine and a rather complete one of the electrical equipment is made. The following are the major items usually included in this inspection:

1. Checking dc brush length and replacing brushes where required.
2. Cleaning of commutators and slip rings of armatures.
3. Cleaning electrical contactors, relays, etc.
4. Checking operation of protective and shut down devices, both electrical and mechanical.
5. Tightening all engine bolts, pipe flange connections, exhaust heater connections, etc.
6. Replace leaking gaskets, washers, etc.
7. Perform any other repair or maintenance item which has been previously reported for that particular unit.

Approximately once a year, the following additional items are inspected and serviced:

1. Governors.
2. Check ignition distributor points, reset points, check ignition transformer oil level.
3. Remove and regap spark plugs.
4. Lubricate auxiliary motor bearings.

Approximately at two and a half to three year intervals, it is necessary to partially disassemble the engine to check compression rings and replace the top two compression rings. At the same time check bearing clearances, gear wear, and general appearance of inside of engine; however, the main crank and the lower main bearing and thrust shoes are not checked at this time. Experience indicates that the wear in the cylinder is only about .00025" to .0005" on the diameter per 1000 hours of operation. Therefore a rebore job or cylinder renewal would not be required for possibly 10 or 15 years of operation. Of course, proper lubrication and oil filtration is a necessity.

The routine 120 day inspection is performed by a definite crew. The service schedule is set up in advance so that all people concerned, both in operating and maintenance, know each day which engine will be down and can plan their work accordingly. Each crew consists of an electrician, a mechanic, a pipefitter, and two helpers. This crew is not occupied the entire day on routine inspections at all times; however, it is necessary to maintain this number of men in the crew in order to insure that at all times they will be able to finish the routine work on the particular engine. The yearly inspection items are merely added to the 120-day inspection at the proper interval and this work is taken care of by the regular crew.

At Alcoa the engine disassembly involving piston ring replacements is performed by special crews.

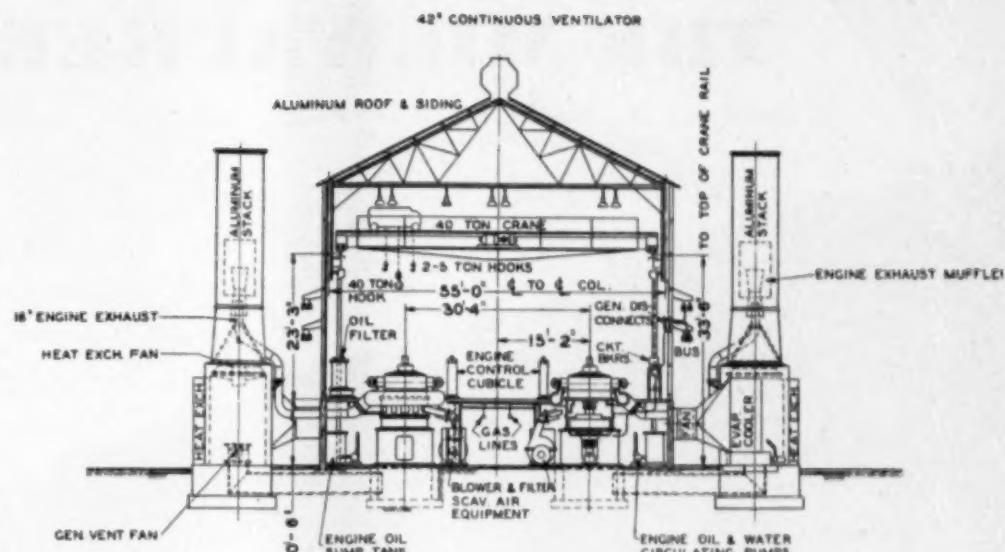


Fig. 7. Section through typical engine house.

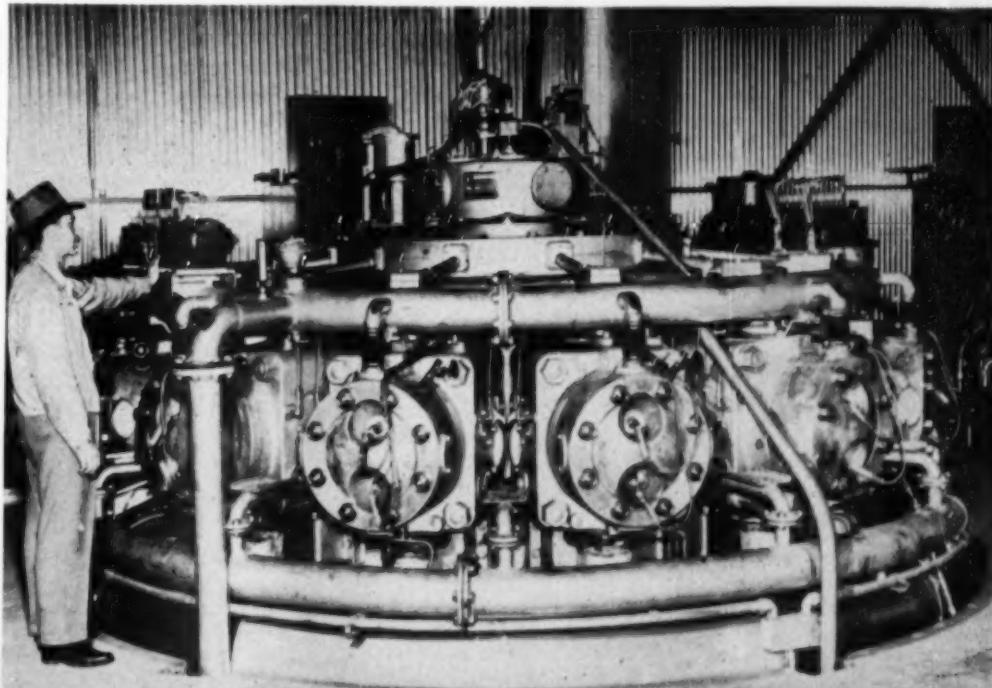
These crews normally consist of three men, that is, two craftsmen, and one helper, and they are able to complete the disassembly of an engine, check all clearances, clean pistons, install new rings as required and reassemble the engine in 32 hours.

Let us consider at this point, features of radial engine installations that have not been covered, but are relevant to our hypothetical plant. Time, in our day, plays a decisive role. It is against it that we often measure our accomplishments. Engine installation time, certainly an important consideration, is likewise significant and bespeaks a definite advantage of this type of engine. The rapid construction of the Kaiser reduction plant at Chalmette, Louisiana has often been termed a marvel of production and I believe rightly so. From the time contracts were awarded for 80 radial engines of the 11 cylinder type to the date the first potline produced aluminum required but 10 months. The second potline was in service two months later. To manufacture these engines, generators and auxiliaries and equipment and have them on the line in the time allotted necessitated a well coordinated manufacturing effort and the

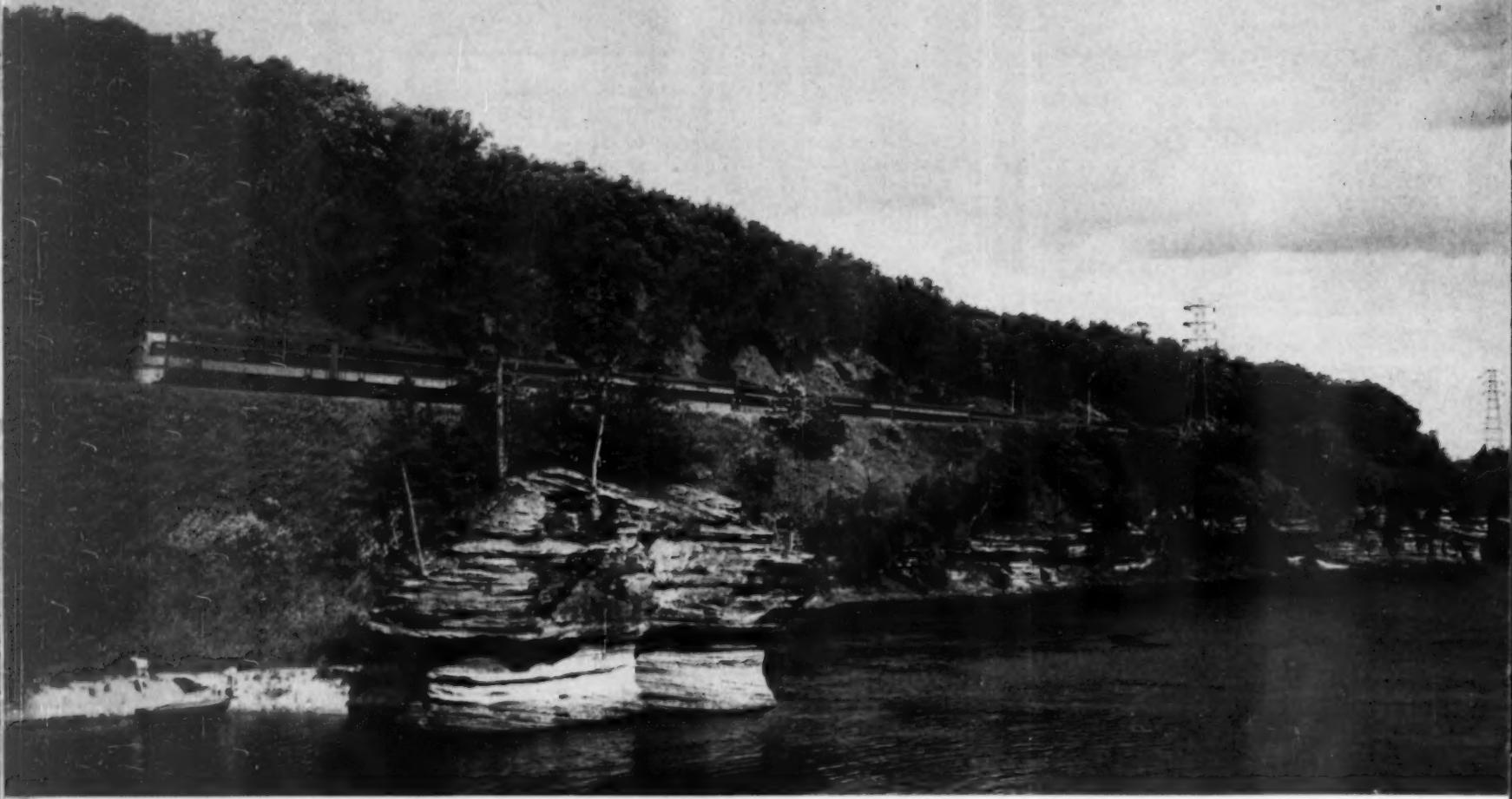
equivalent shipment of one fully assembled engine a day for a period of two and a half months. The engines were shipped by flat car to the installation site as shown in Figure 8.

The compactness and relatively small size of the engine coupled with the use of non-critical materials when compared to other forms of power equipment offers a distinct advantage to its use for power generation. Steam and hydro plants in operation and those under construction are set up to generate ac power. This power, to be suitable, must therefore be converted to direct current with the necessity of building and operating rectifier stations, the initial cost being approximately \$60 to \$70 per kilowatt installed. The operating information contained herein is based on 120 engines which have been in service an average of 20,000 hours each. The gas-burning radial engine offers low cost, efficient power generation with minimum upkeep throughout its entire operating span. It is this combination of attributes which makes it ideally suited for use in the electrolytic reduction of aluminum or for other continuous heavy duty power plant service.

Fig. 1. One of 74 Nordberg 12 cylinder radial engines installed in Aluminum Company of America's plant at Point Comfort, Texas.



THE MILWAUKEE ROAD



The Twin Cities Hiawatha at Wisconsin Dells, Wisc.

By CHAS. F. A. MANN

THE 33 diesel passenger engines comprise 16 3-unit FP type EMD's, 6-2-unit regular 2000 hp. EMD passenger units, 1-4000 hp. Alco and 10-2-unit 4000 hp. F-M diesels. Twenty-seven of this fleet work out of one single diesel passenger pool—Western Avenue, Chicago, where they are maintained. Thus the diesel power on the Milwaukee Railroad is about 75% concentrated out of two great terminal cities—Chicago and Milwaukee, and all the rest is thinly spread over the sprawling rail network beyond the turnaround points served from these two Terminal cities.

The operation of Bensenville freight diesel pool is a shrewd, scientifically worked out plan that gives a typical 4500 hp. freighter about 7500 miles of running per 28-day cycle with from 3 to 9 hours layover and service time per day. In this pool, reaching Omaha, Mitchell, So. Dakota, Mason City, Iowa, Duluth, St. Paul and way points, the 28 diesels work a monthly rotation schedule that gives equal mileage to most of them. Operation of the 19 diesels in the Milwaukee freight diesel pool is likewise figured to the mile and hour, giving this fleet about 6700 miles with from 6 to 18 hours layover and service time in an 18 day cycle. This pool reaches out to Harlowton and Lewistown, Mon-

Editor's Note: This is Part II of this article. Part I appeared in the April 1953 issue of DIESEL PROGRESS and outlined the spectacular expansion of the Milwaukee Road westward and their successful experiment with electrification when steamers ruled the roads.

tana in the far west, Kansas City, St. Paul and Channing, Mich., in the far north. The first leg of a typical assignment is the grueling 7-day run from Milwaukee to Lewistown, Mont., and right back again to Milwaukee, rolling up 2796 miles with only 14 hours service and layover time! This makes it one of the stiffest diesel freight locomotive operations in the nation. Next morning it starts the 1046 mile round trip to Kansas City, then the round trip to Channing, then a round trip to Rondout, then the Kansas City round trip with a side trip to Nahant and finally a round trip to St. Paul! All in 18 working days! It takes 18 regular and 1 spare locomotive to work the cycle.

The Western Avenue passenger pool is broken down into groups, to give from 842 to 890 miles per day per diesel locomotive on the "hot" runs 470 to 730 miles per day on the slower runs. The Chicago-Milwaukee-Madison short runs for the

2000 hp. single cab diesels average about 375 miles per day. The pool idea of diesel operation has become a fixed, ingenious part of Milwaukee operation, with "Reporting to the Boss" the rule for setting up new pools. Field surveys by Messrs. Rycroft and Crippen, reporting direct to President John Kiley and Operating Vice President L. F. Donald, are developed from objective studies as to how to set up a pool of diesels of exactly the right size and weight to do as much work and run the greatest mileage in a cycle or a month, replace as many old steam clunks as possible and not cause the bridge and building and maintenance of way departments the slightest trouble in the way of fresh demands for heavier rail, smoother track and more service facilities!

Take the Great Falls long network of important feeder branches. The big 5400 hp. freighter off the fast coast freight No. 263 brings the cars to Lewistown every morning. By installing 4-1500 hp. EMD diesels—the new 6-wheel type—a neat little pool working out of Lewistown, as single road units or 3000 hp. road units or single yard-switchers, takes care of the Lewistown-Great Falls line haul and switching work; the Great Falls-Agawam run and the Lewistown-Winnemucca run, and do all the

switching in these three territories, leaving a single steam teakettle run on the Roy-Winifred branch. All helper service on the Lewistown-Great Falls hill was eliminated and overtime on the road cut out. Just a little pool of 4-1500 hp. EMD road switchers cut expenses more than half! Maintenance is done in Lewistown Sundays.

Over on the Idaho Division the Avery-Othello gap between electrified zones now has 2-4500 hp. EMD freight diesels doing all the work and averaging 454 miles per day, while 3-4000 hp. EMD 2-unit passenger diesels work the Spokane line and run 908 miles in a 3½ day cycle, and protect against storm-delayed passengers from the East as well as military extra trains.

Last year, the Crippen-Rycroft pool experts cooked up another ingenious diesel schedule out on the Idaho Division comprising 4 cow and calf 2400 hp. 2-unit road switcher EMD's for the light Elk River and Metaline Falls branches. And also the Spokane-St. Maries local freight connection with the mainline freight trains. By pooling the power requirements and setting up tight schedules, these three widely scattered services are now run with the 4 cow and calf units, making 516 miles in a 5-day cycle on some of the wildest, roughest branch-line territory in the whole west, plus keeping close schedule on the important Spokane freight connection. The lightweight power, spread out amply, keeps the track in good shape and no bridges had to be rebuilt or curves straightened, yet plenty of power to negotiate the 2.5% grades on the Elk River Line and low center of gravity for its 17 degree curves. Out on the Coast Division, every mile of track west of the Cascades is now dieselize.

The weird assortment of heavy traffic branches, two of them reached only by long rides on carfloats on Puget Sound, the lightweight rail and the heavy grades, all fit the diesel beautifully. On the Bellingham line two 1500 hp. 6-wheel EMD road-switchers and a 600 hp. EMD yard switcher do all the work between there and Glacier. A single 1500 hp. 6-wheel EMD switcher does all the work on the Pt. Townsend-Pt. Angeles line. The Everett-Cedar Falls-Enumclaw lines use a 2400 hp. cow and calf EMD, and a 1000 hp. and a 600 hp. EMD switcher. The Tacoma-Seattle way freight, of all things, runs right under the trolley wire via a 1000 hp. EMD switcher. The Chehalis-Raymond line has another 1000 hp. EMD switcher. Tacoma-Morton, where the log trains are long and tricky and the grades up to 3.7%—heaviest except one in the whole West, and sharpest curves—up to 25 degrees, pioneered diesel with the now famous No. 80. This 6000 hp. EMD job was especially low-gear'd to run on this awful mountain branchline. It will haul 132 empty log cars up the 3.3% grade out of Tacoma or pull from dead stop 400 loaded boxcars on level track! It is geared down to 40 miles per hour and exerts 250,000 pounds tractive effort at starting and is heavily ballasted with iron.

The Tacoma-Morton and Tacoma-Longview operation now consists of a pool of one 4500 hp. and four 3000 hp. EMD freight diesels, part of which consist of 2-1500 hp. new type, 6-wheel EMD road-switchers. The Tacoma-Hoquiam-Aberdeen opera-

COST PER 1000 GROSS TON MILES FOR ELECTRIC POWER AND ELECTRIC LOCOMOTIVE MAINTENANCE FOR FREIGHT TRAIN OPERATION

Rocky Mountain and Coast Division: C. M. St. P. & P. RR Co.

Years: 1947 to 1951 Incl.

Statistics:	1947	1948	1949	1950	1951
MGTM	3,296,459	3,354,933	3,193,389	3,288,590	3,344,951
Kwh. per MGTM	36.9	37.6	37.1	40.4	40.8
Cost per Kwh.					
Electric Power	\$0.006310	\$0.006240	\$0.006340	\$0.005600	\$0.005265
Power Station—Operation	.001600	.001660	.001839	.001832	.001819
Power Station—Maintenance	.000511	.000389	.000411	.000398	.000540
Power Line—Maintenance	.000914	.000933	.001147	.000833	.000944
TOTAL	\$0.009355	\$0.009222	\$0.009737	\$0.008663	\$0.008568
Cost per MGTM					
Power Charges	\$3450	\$3465	\$3610	\$3500	\$3493
Locomotive Repairs	.1637	.1822	.1937	.2585	.2624
TOTAL	\$5087	\$5287	\$5547	\$5885	\$6117

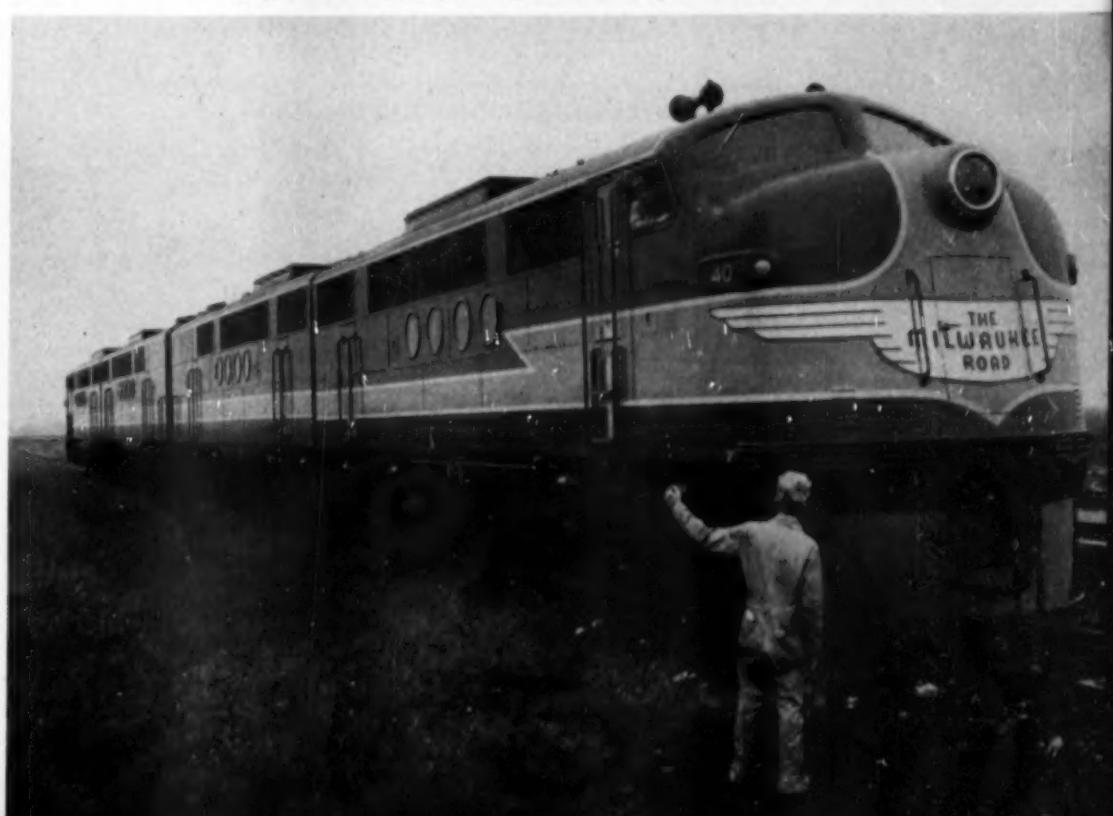
tion is run by a 1000 and a 1500 new type EMD road switcher pair of diesels. The only other sizeable diesel freight pool using the regular 1500 hp. EMD freight diesels is on the D & I Division, operating out of Savanna, Ill. to Sioux Falls, Austin and St. Paul. Here 6-3000 hp. EMD freight units work in a pool, on a 6 day cycle piling up 1860 miles on a series of tight schedules. These are all maintained at Savanna.

The Milwaukee is a heavy user of the 1500 hp. diesel road switchers. A fleet of 22 Alco 1500 hp.'s work important branch lines over a large territory. The fleet of 13 EMD 1500's has been largely accounted for except 7 working in Wisconsin and South Dakota. Some 67 Alco; 22 Baldwin and 24 Fairbanks-Morse 1000 hp. switchers are spread over the whole system for yard work. Thirty-two Fairbanks-Morse 1200 hp. switchers work principally in Milwaukee, while 13 Baldwin 1200 hp. switchers work principally in St. Paul and Minneapolis. And the fleet of 11 little 380 hp. GE, Whitcomb and Davenport switchers work the small terminals where loads are light. Now the Milwaukee runs about 90% of its passenger service, 80% of its

freight gross ton miles and 70% of its switching hours with diesel, plus another 10 percent of its gross ton miles and 12% of its passenger car miles with electric power.

These figures are remarkable when one considers that the company has a sizeable fleet of modern steam power it cannot afford to scrap; operates in a heavy coal territory and has many spots where old steamers written off the books carry peak loads, such as in the Chicago commuting zone and where traffic needs power say only 20% of the time in a given week. Hundreds of miles of Milwaukee branchline are so thinly traffic'd that two or three trains per week will serve 100 miles of line! So, the Milwaukee meets the new day in its vast West with a power plant modernized and second to none in the West, for the first time in the last 40 years of its history. Its investment in America's longest electrified railroad has been proved sound, and with the modernization program far underway, it will merge equal to diesel in speed, surpass it in the rough mainline mountain territory, and still outpull any type of motive power, when working freight, that has yet been devised.

The historic Milwaukee diesel freight No. 40, first freight diesel ever bought and built expressly to run freight trains across the gap between the two electrified zones between Avery, Idaho and Othello, Washington. It's a 5400 hp. 4 unit EMD.





One of the Milwaukee's Alco-GE diesel electric 1000 hp. switching locomotives.

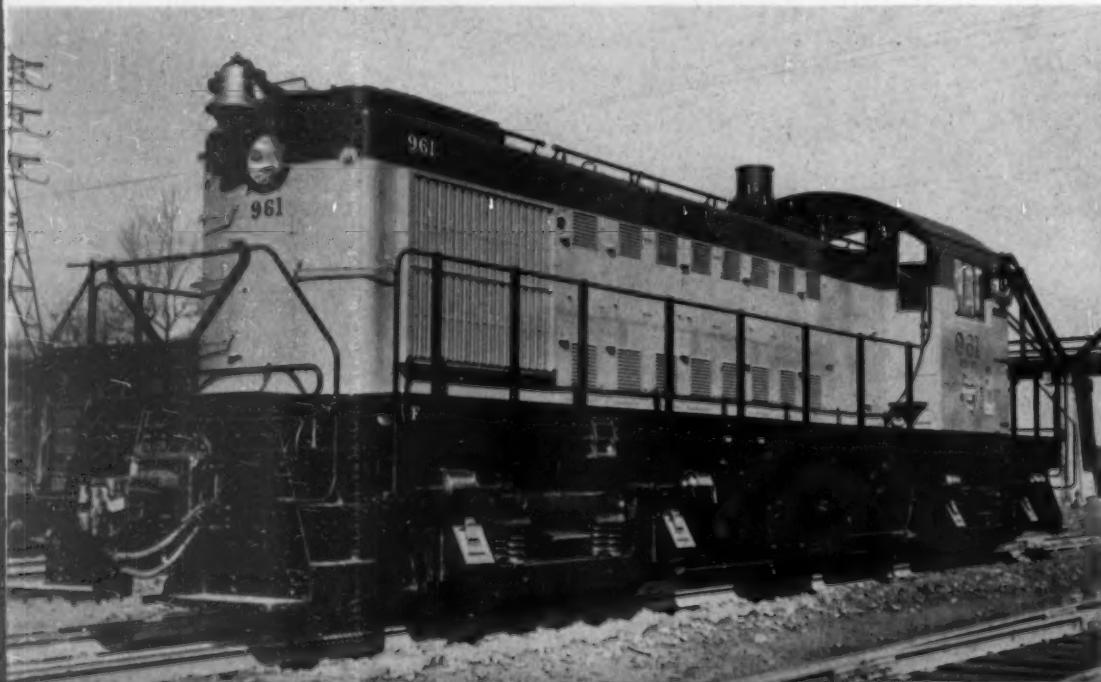
Perhaps the most interesting phase of the Milwaukee's "New Look" comes from heavy capital outlay in bringing its aging electrification up to modern standards. The trolley and substation system are as good today as when first built. The great dividend comes from the fact that some 12% of the total electricity bought is regenerated by trains going downhill, and recovered, in the Rocky Mountain Division electrification and 16% on the Coast Division electrification, or more than enough to recover all line losses!

While only a few diesels run in mountain territory are equipped with dynamic braking, the principle established back in 1914-1916 by the electrification, has already saved a fortune in brake shoes for railroads not electrified but using dynamic braking in the mountains. The Milwaukee puts its dynamic braking savings right back in the trolley! Cash in the bank. At Tacoma, the first high speed passenger electrics built since the system was electrified, two 2-unit high speed electrics, are being built out of four GE freight units, into twin 2-unit streamlined modern electrics. They were to be finished in

March and sent to Montana to replace 3 aging Westinghouse passenger electrics whose maintenance costs have risen to nearly 90 cents per mile. These three will be retired and parts salvaged for the rest of the small group, which in turn will be placed in reserve. The two new Tacoma-built jobs — fresh from the same shops that do all the work on all diesels operating in Western Washington, plus two of the new "Little Joe" electrics, will do 90% of the passenger work on the entire 440 mile Montana electrified line.

After long study of snowplows driven by steam, diesel and electricity, electrical boss Wylie has invented a scheme to put two standard traction motors out of one of the electric locomotives on a single snowplow wheel, and deliver 1600 horsepower to the blade! Next he's going to put motors out of diesel locomotives into another snowplow to operate in non-electric territory! Instead of fighting 20 foot snowdrifts with 600 or 800 horsepower, Mr. Wylie believes in using as much power to turn the wheel as it takes to push it with a locomotive against a snowbank! He expects to end delays due

EMD 600 hp. diesel switch engine employed on the Milwaukee Road.



to snowslides in the Cascade mountains with his new ideas. Trains have been stalled up to 20 hours, barely 40 miles East of Seattle, as recently as 1951.

The advent of diesel on the Milwaukee gave the whole operating personnel a new approach. Now it is possible to train a man in Milwaukee to handle and repair diesel electric power, and yet he is perfectly at home when he goes West and starts to work on the big electrics at Deer Lodge or in Tacoma. And, an electric locotive trained man at Tacoma can do a better job on the new diesel fleet operating out of there.

The dead heart of Washington is now a roaring boom camp as Columbia River water is being fed to the fertile desert surrounding the Milwaukee lines. The dream of the founders of riches in the West are at last coming true. Traffic is rising. Costs written off of the electrification dream of 45 years ago are now paying dividends. The accounting office in Chicago can keep a system-wide appraisal of operations for the first time in the railroad's 20th century history. And for the first time in nearly

Why the Milwaukee Fights to Modernize and Retain Its Electrification Yet Presses on Toward 100% Dieselization in a Nutshell

A 3-unit EMD 4500 diesel has just brought a 5000 ton freight in from Othello, 227 miles to the west, where the Coast Division electrification ends. No. 264 East is the No. 1 transcontinental freight that runs by timetable like the Hiawatha and Columbian. It makes schedule including stops, over the low-grade direct line in about 11 hours. Brake testing, servicing, lagging behind time for delayed westbound trains due to blizzards in the Dakotas, #264 East leaves Avery, Idaho, for the 440 mile trolley ride to Harlowtown, at the east end of the Little Belt Range. At the head end is a 3-unit electric, E. 35, 5100 hp. 47 cars back in the 90 car 5160 ton freight, is a 4-unit electric helper, E. 34, rated at 6680 hp. These 80 loads and 10 empties roll over the Bitterroot range at a steady 13 mph. Thirty years ago these two locomotives, in slightly different combination, pulled the same tonnage at the same dependable, safe speed. Nothing like it surviving in U. S. or European railroading. Veteran engineer Guy Lovely and Tom Cooper, fireman, enjoy their Van Dycks, between apples, sandwiches, and pointing to thinline, "engravers fine" deer tracks by the thousands at every turn, in the snow blanket below and above the tracks. But for contrast, we get off at Albion, Mont., and after coffee, leave there westbound for Avery, on the 9 car Columbian, with a single unit Little Joe electric. Engineer Grover Emby confides, halfway through the 69.4 mile trip, that he is running a bit more than half throttle tonight, because the board chairman, Leo Crowley, is on behind in his private car and wants to get to the coast on time. The 5000 hp. electrics Joe Stalin missed getting for his Russian railroads yank 9 cars uphill, at half throttle. Looping back to Butte, in a cozy bedroom on No. 15, the Olympian Hiawatha, the porter yells "Butte next" while we still dreamed of the deer tracks on the west slope of the Bitterroots, eastbound on No. 264 in the glaring afternoon winter sun. Aboard #264 again, (we overtook it on the fast night ride

50 years, the whole Milwaukee system, under President John Kiley is one railroad—instead of two fighting halves. The boys out on those wobbly little branchlines that bring down timber, lumber, ore and farm products never know when their friendly new Big Boss will drop by and look things over. In the old days they had to apologize for their rundown status and poor housekeeping. Now they proudly point to the new diesels, the profitable runs that used to be profitless and the faster service that everybody likes.

The last of the transcontinentals is at long last coming into its own, and the pioneering and innovations that were blocked when the tide of commerce followed the Panama Canal, is now paying off as the Northwest frontier begins a boom such as it has not seen before.

For a 12 month period ending January 1, 1952, the remaining fleet of Milwaukee steamers, then totalling 665, showed an average maintenance cost per mile run of 46.8, with a high of 87.8 cents and a low of 31 cents. In that same period the electric

of the Hiawatha) at 9:20 out of Butte, with Engineer E. B. Bennett and R. D. Lemon, fireman. The train now has 82 loads and 3 empties, totalling 5245 tons. The stiff Continental Divide at Pipestone Pass requires the heaviest power operated on a regularly scheduled U. S. freight. Two 5100 hp. Joes—coupled together they're Big Joes, and 35 cars back, a 3-unit 5100 hp. E. 27, gives 15,300 horsepower to roll along 13-14 miles per hour to Pipestone Tunnel, then the same speed downhill, entirely with regenerative braking. More than 20% of the electric power used to run the train uphill, is returned to the trolley and substation meter, going downhill, to be credited to the day's power costs. Considering the heavy line losses; the losses in the substations, transformers to the substations and in the traction motors, this is again an astounding performance, that no diesel dares to challenge. Electrification is in. It operates perfectly. It was built when the dollar was worth 2½ times what it is today. So that's it. At Three Forks, with tonnage cut to 4700, the helper cuts out, #264 is off to Harlowton. It crosses the Belt Range with no aid. The 10,200 hp. Big Joe almost sticks in the icy rail in Montana Canyon. But Engineer Levesque, with a 3 foot wrench, frees a clogged air sander and knocks ice loose in a train airline, and away we go. In 5 hours and 15 minutes the last leg is run. From there on, the Milwaukee Freight Pool No. 2, with those 19-5400 hp. diesels picks up No. 264 at 7 p.m. and takes it clear to Milwaukee, Wis. Remember, these diesels behave like the Electrics. This Pool operates in 2796 mile cycles with but 14 hours off for servicing! And on Passengers, between Chicago—not Milwaukee—clear to Harlowton, 3-4500 EMD FP type diesels averaging 870 miles per day and another identical 4500 hp. trio, averaging 890 miles per day, keep two pairs of transcontinental passengers running like clock, month in and out, on 2670 mile cycles with 6-8 hours service and turning time.

The foreseeable future on the Milwaukee is Diesel and Electric. Period.



2400 hp. EMD "cow and calf." Used for road switching and running on light roadbed.

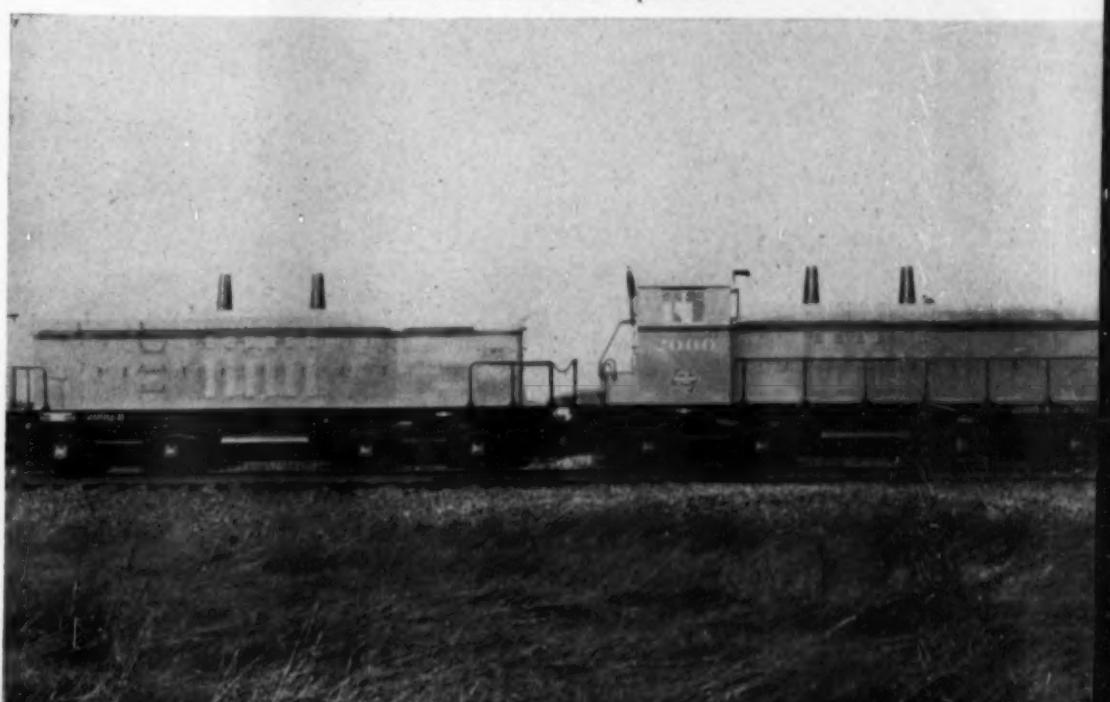
locomotives, comprising 108 units, had undergone a period of heavy deferred maintenance. The old and the new averaged together, showed a maintenance cost per mile of 33.1 cents, with a high, for the aged Westinghouse passenger electrics of 84 cents per mile and a low of 11.2 cents for the new "Big and Little Joe" electrics, and 6.2 cents for the small fleet of old electric switchers. Perhaps the most astounding fact of all showed up in the General Electric freight units, the bulk of which dated back to 1916, the average maintenance on the whole fleet of 80 was 29.8 cents. Considering the fact they ran exclusively in freight and were mostly 35 to 37 years of age, it is a remarkable showing. The 5 bipolar gearless locomotives on the Coast division turned up with 62.7 cents per mile, a remarkable showing for power placed in service in 1919.

For the same period, 483 diesel units turned in an astounding average of only 16.2 cents per mile! This lumps together the old switchers dating back to 1939 and some of the earlier prima donnas. Some of the EMD 4000 hp. passengers showed each unit costing 48.2 cents per mile maintenance, while the

4500 hp. new EMD freight diesels showed their 1500 hp. units only cost 7.2 cents per mile and the companion 4500 EMD passenger units, newer of course, were down to 4.1 cents per mile. The lone big 3200 hp. Baldwin transfer diesel only cost 14.1 cents per mile to operate, while one group of switchers of another make cost 16.7 cents per mile and another group of 600 hp. switchers cost 41.2 cents per mile. The largest group of 1000 hp. switchers, all Alcos, showed up with only 13.7 cents per mile for maintenance.

Editor's Note: The table on page 53 is perhaps one of the first of its kind to ever be published. Statistics on electric locomotive and electric railroad operation are rare, and hard to segregate from the usual composite statistics kept by railroads. These were compiled expressly for DIESEL PROGRESS to answer a number of questions about electric operation on the same basis and in the same language as modern day railroaders now keep diesel operating statistics. The table "Cost per M (1000) G.T. M." clearly shows "fuel" costs to an electric locomotive, just as diesel fuel costs would apply in the case of diesels.

The New Deer Lodge, Montana, electric shop. Electric motors and generators for both electric and diesel-electric locomotives are repaired here.



NATIONAL SUPPLY ATLAS DIESELS IN NEW PHILIPPINE TEXTILE MILL

**The Installation of Modern Diesel Equipment
Expected to Give a Tremendous Boost to the
Industrial Development of the Islands**

By DOUGLAS SHEARING

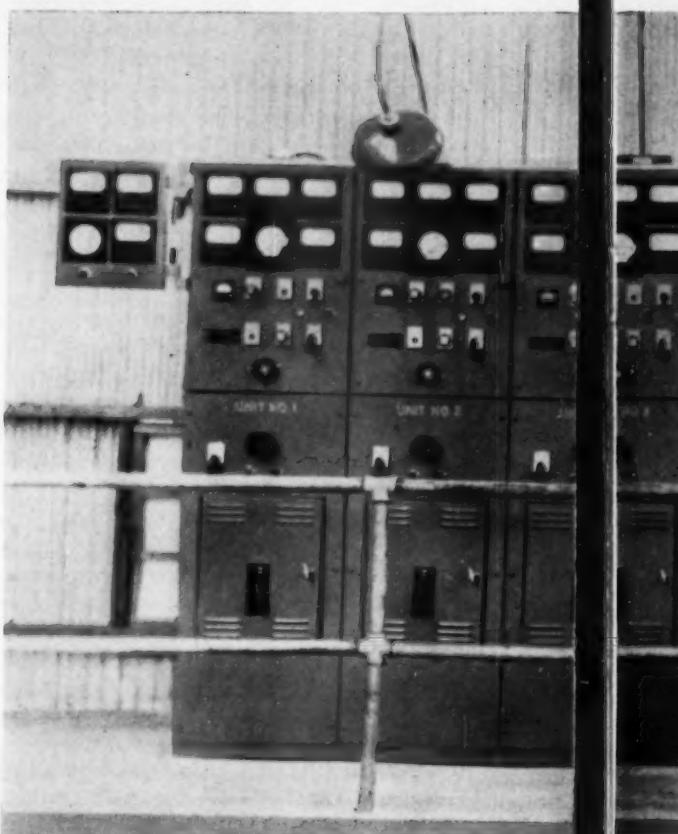
A NEW spinning mill, created largely from residue of the Japanese occupation, seems likely to have a distinct effect on the industrial development of the Philippine Islands. Located near Narvacan, Ilocos Sur, on a site of 10 hectares (approximately 25 acres), the mill is the only one of its kind in the Philippines outside of Manila.

Built by the government development agency, its

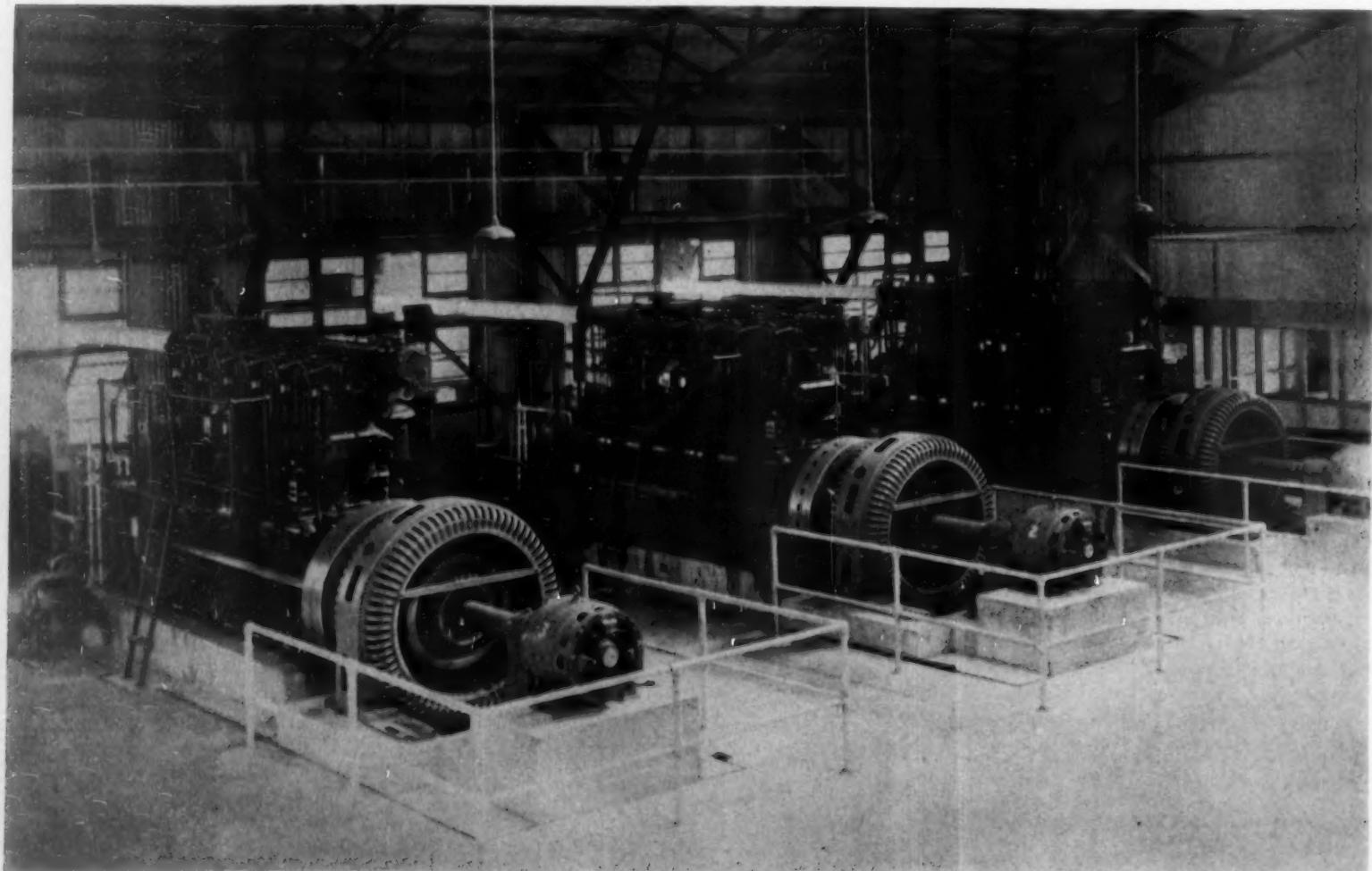
purpose is primarily to produce yarns to supply the needs of home weavers and makers of fish nets in the Ilocos and Northern Luzon provinces. Excess capacity, however, will permit the mill to supply other regions.

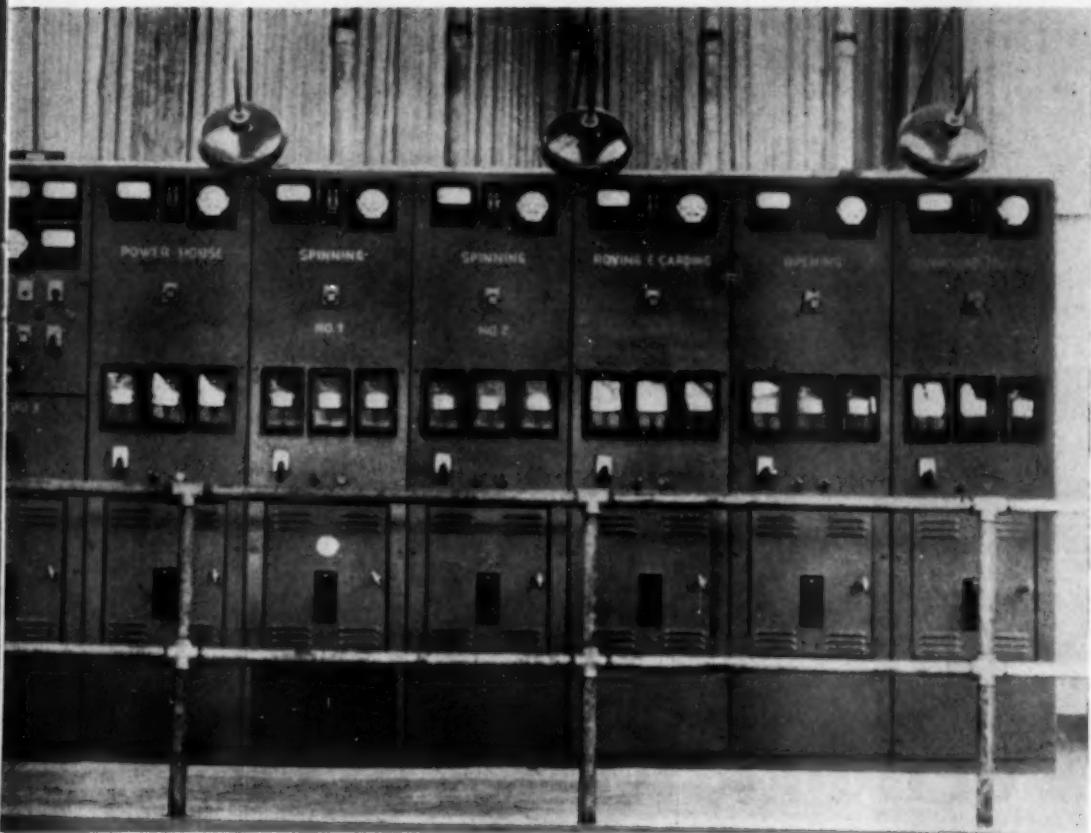
The major portion of the materials used in the mill were salvaged from mixed crated and loose pieces of old cotton mill machinery dumped near Manila

View of the power house of the new textile mill at Narvacan, Philippine Islands. Power is supplied by three Atlas diesel engines, each developing 350 hp. at 360 rpm.



The efficient control panel in the Narvacan textile mill.





by the Japanese during the World War II occupation. Early in 1949, the National Development Co. began the painstaking work of collecting, sorting, and cataloging the scattered parts and units. The piles of machinery were then transported to Narvacan, where the mill was ready for test runs in 1951.

Three Atlas diesel engines, each of 350 hp., 360 rpm., manufactured by the National Supply Co., Springfield, Ohio, were installed as the basis of a modern power plant. Francisco R. Lopez, assistant general manager in charge of the textile mills, says any two of the engines could well take care of the load. He explained that the combined demand and diversity factor in textile mills is 90 per cent, which is rather high compared to other industries. The Atlas engines have complete alarm control equipment, including alarm horn, combination low oil pressure-high temperature switch and thermometers. Alnor pyrometers and thermocouples are installed for quick checking of exhaust temperatures.

A Ross Heat Exchanger is an integral part of each engine. The entire power plant is self-contained and housed in a well-designed high-ceiling powerhouse adapted to the tropical conditions of the locality, with natural free-flowing ventilation at all times.

Because of limited bridge loadings and other transportation difficulties, it was necessary to ship the power plant equipment dismantled, for erection at the site. The simplicity of the Atlas engine design made it easy to overcome this difficulty. Atkins, Kroll & Co., Manila representative of The National Supply Co., handled arrangements with the National Development Co. The mill equipment includes: 80 sets, carding machines, one delivery per

set, 6 sets, drawing machines, 8 deliveries per set, 12 sets, roving machines, 122 spindles per set, 44 sets, spinning machines, 420 spindles per set, 1 set, opening and picking machines, one delivery per set, 20 sets, skein winders, 30 deliveries per set, 2 sets, cone winding machines, 100 deliveries per set. The cone winding machines are of American manufacture. All of the others were manufactured by various Japanese concerns.

The installation of these three Atlas diesels is an outstanding example of how such modern equip-

ment can give an entire economy a big boost. The islands which will be supplied with yarn from the mill will unquestionably benefit by more than just the employment it will give to several hundred men and women. It is certain to act as a stimulant in encouraging further development in cotton raising and transportation.

"In full operation," says Mr. Lopez, "The spinning mill is expected to produce from 4,000 to 5,000 kilos (approximately 4400 to 5500 yards) of yarn per day of three shifts, depending on the yarn counts and the number of spinning frames appropriated for each size or count of yarn spun. It is well suited to the production of fine yarns for shirtings and thread purposes, a field which may be developed in the future." The mill has a large warehouse, as well as its own machine shop and water supply system. Housing and recreation facilities are provided for employees and there is a medical clinic and a cooperative store. About 200 men and women are employed at present. In its first three months of operation, while still undergoing trial runs, the mill produced yarn valued at 58,879.96 pesos, or about \$17,664. The Philippine government is now sponsoring scientific cotton growing, in order to insure a steady supply of raw materials.

List of Equipment

Engines—National Supply Company. Three Atlas Model 6HS1558, 6-cyl., 11½-in. bore by 15-in. stroke, 350 hp., 360 rpm.

Governors—Woodward.

Generators—Ideal Electric.

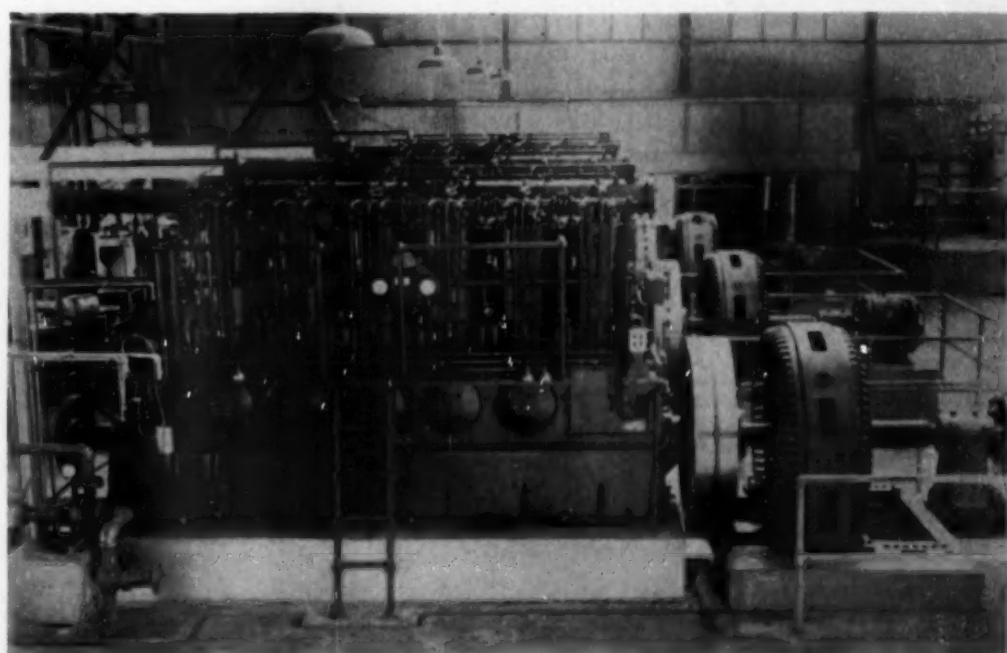
Generator Control Panel—Ideal Electric, consisting of 3 generator control panels, 1 swinging synchronizing panel, 6 feeder panels.

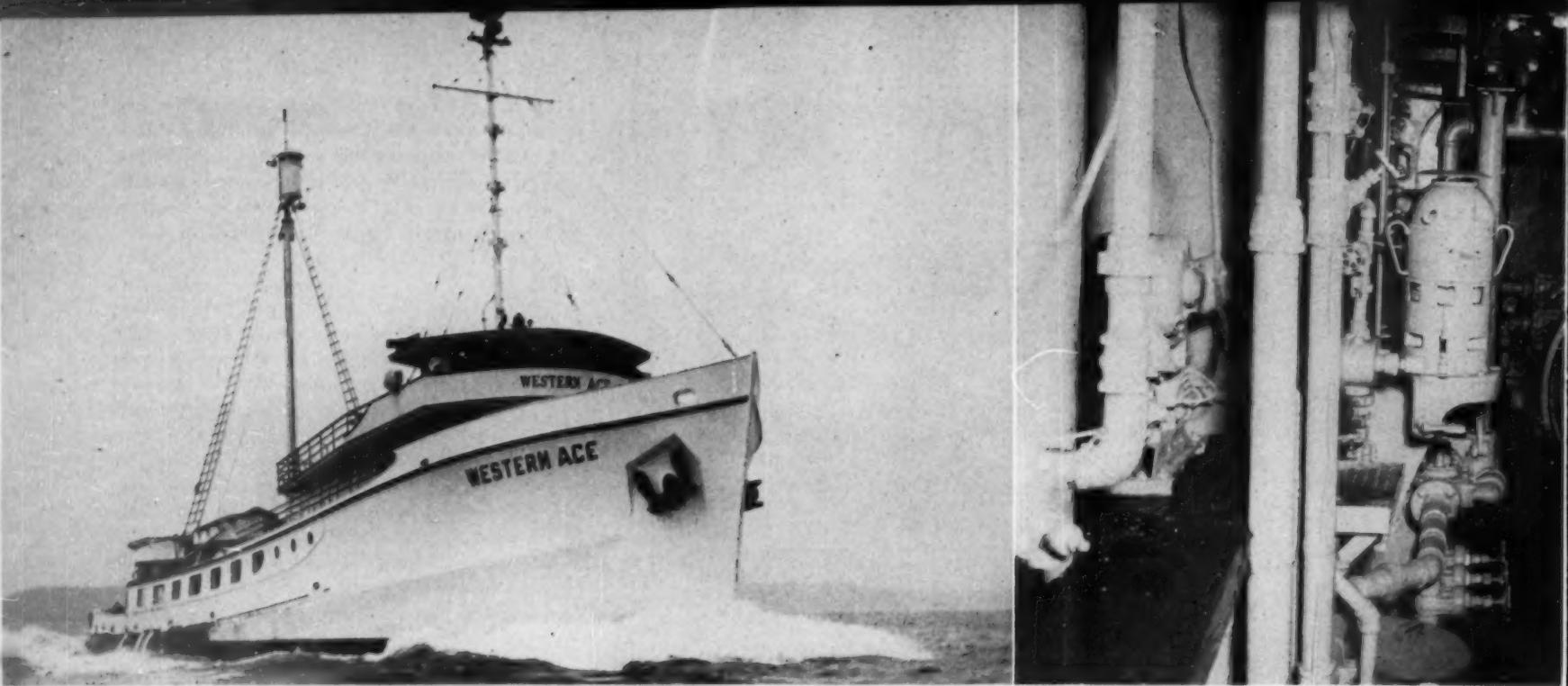
Water Cooling—Marley.

Exhaust Silencers—Maxim.

Air Compressors—Quincy.

Close-up of bank of Atlas engines which were supplied by The National Supply Company.





The new giant tuna clipper *Western Ace*.

GIANT TUNA CLIPPER PACKS OVER 2,000 Hp. OF DIESEL

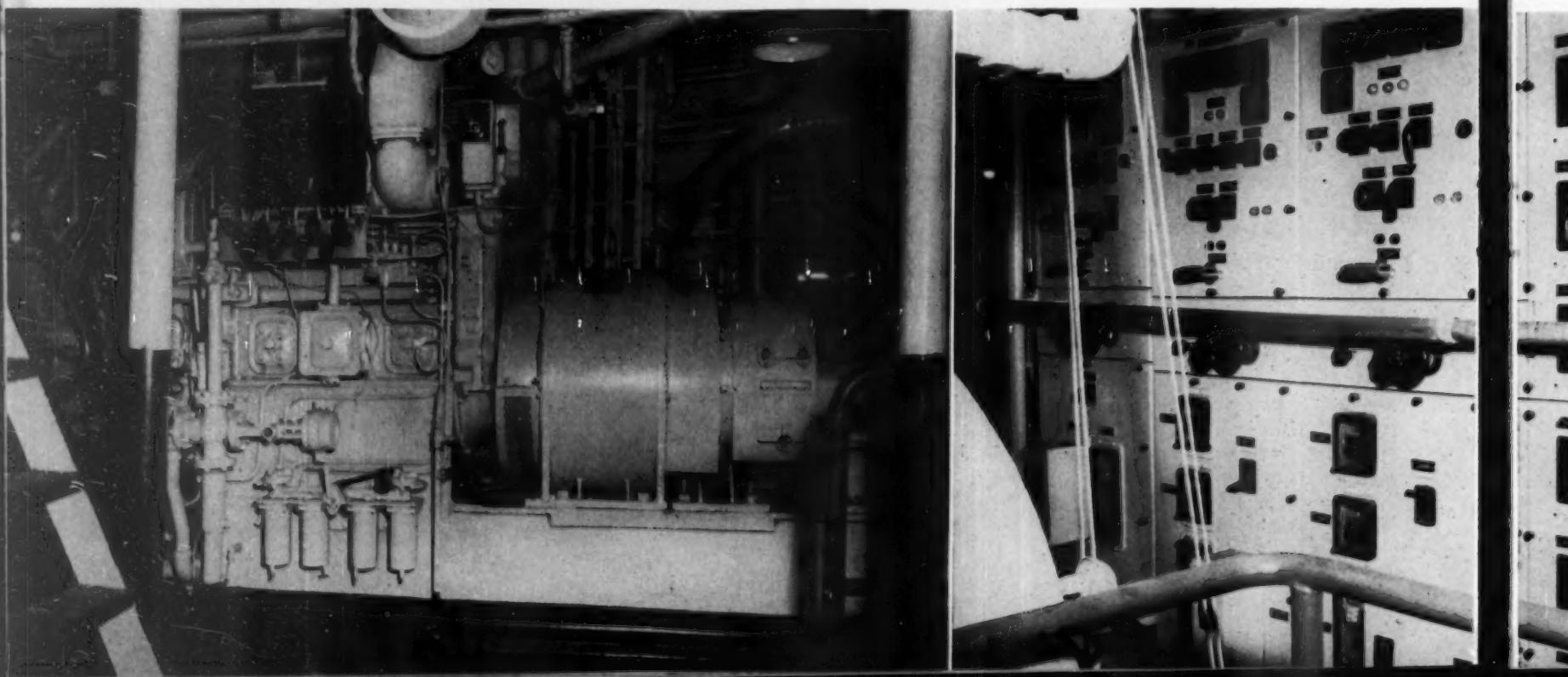
By CHAS. F. A. MANN

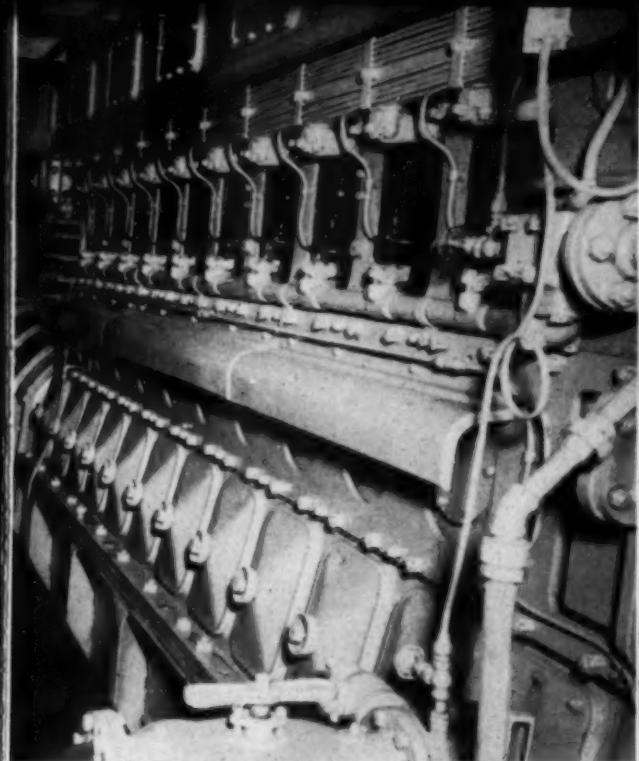
FOR the second time, a heavily built, "like-new" wooden ex-steam powered Army tug of the type hastily rushed for war duty ten years ago, has now been converted to a super-size giant tuna clipper, 100% dieselized and all the terrific array of equipment that goes into a vessel of this type. This time it is the *Western Ace*, built and owned by the Petrich family of Tacoma, for operation out of San Diego. This new product of the Western

Shipbuilding Co. at Tacoma, had a prevue season as a freezer ship in Bristol Bay, Alaska during 1952. She mothered a fleet of small Bristol Bay trawlers and brought down over 120,000 whole salmon in her tanks, all frozen.

Late in the fall she returned to Western Boat for full conversion to a giant tuna clipper and sailed south early in February for her new assignment.

She was built originally in 1944 by Wheeler Shipyards in New York, as a heavy wood steam driven tugboat, known as ATR 62. Scarcely used as an ocean going rescue tug, she became the property of Foss Tug & Barge Co. of Tacoma, and was stripped down to bare hull and deckhouse by Western Boat when they acquired it last year. Principal dimensions are: length 169 ft.; depth 17.3 ft.; beam, 34 ft. 1 in.; length B.P., 155 ft., registered length





View of the main Fairbanks-Morse diesel propulsion unit.



On the flying bridge of the *Western Ace*, from left to right: Martin Petrich, Jr. of Western Boatbuilding Co., builders and owners of the vessel; Ralph McCabe, captain; Tony Goulart, 1st mate; and Hervey Petrich, of Western Boatbuilding.

156.2 ft., and gross registered tonnage of 732.89.

In many respects she resembles the first conversion of this type, the giant *Scarlet Queen*, a Tacoma Boat Building Co. product of two years ago. She has a steel main deckhouse and wood pilot house and Texas and is one of the heaviest built vessels of her type ever constructed. As with all tuna clippers, her mechanical equipment is almost fantastic, because of her great size and capacity, and because of certain new innovations devised by her owners who operate many other tuna clippers, as well as having built over 100 in the past 25 years. She carries a crew of 34 in 8 large staterooms. There are 8 large fish tanks below the main deck on each side, six of which will carry nearly 50,000 gallons of diesel fuel for the outbound voyage, returning after the tanks are steam cleaned, with frozen tuna.

There are two large deck bait boxes midships and 4 aft, giving 6 more frozen fish holds to use on the return voyage, a grand total of 22 fish holds.

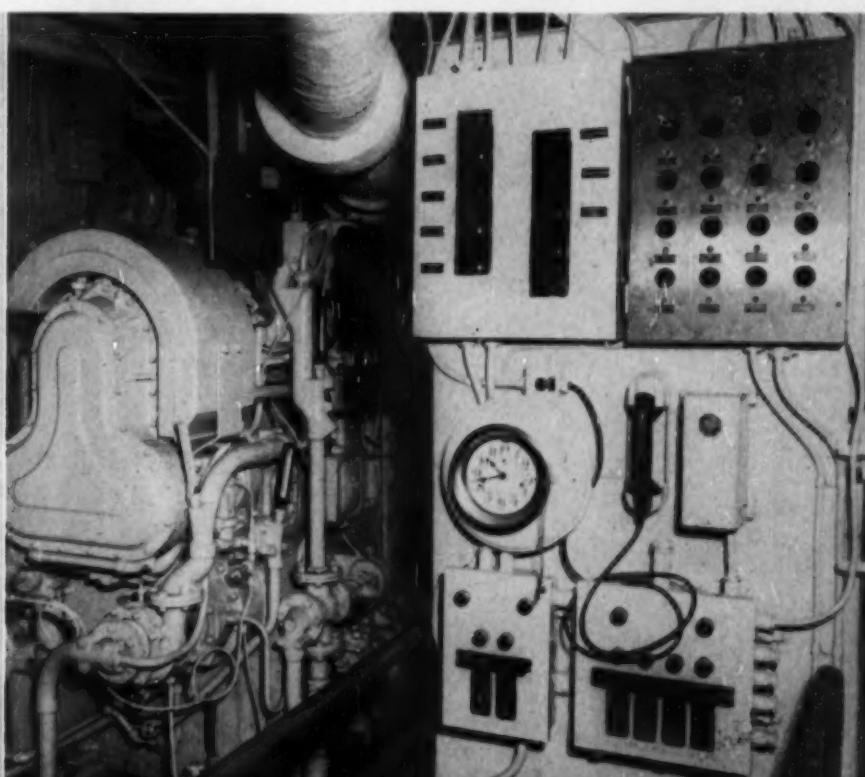
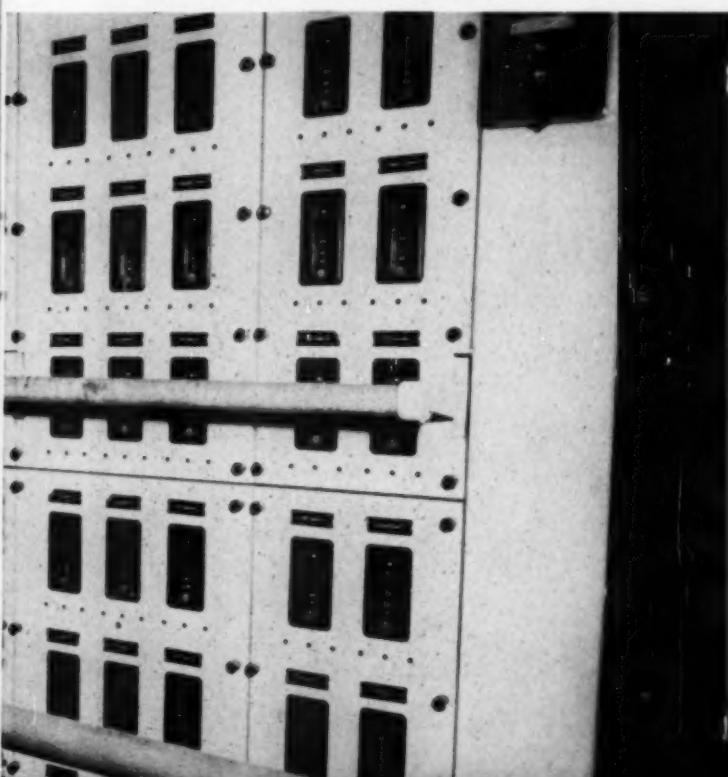
Like everything else, her tank capacities are fantastic, with a total of 88,669 gallons of fuel capacity, including the six steel lined fish holds; 2700 gallons of lube oil and 3100 gallons of fresh water. Total cruising radius at full speed is 45 days and under normal operation is 60 days, with all refrigeration and pumps going full blast in hot weather! The equipment and layout is as fantastic as her other features. Some 35,000 lineal feet of welded and galvanized 1 1/4 in. refrigeration has been fitted in 16 wells and 5 deck bait tanks. Her refrigeration compressors are the largest and most unusual ever fitted in a tuna clipper, and consist of two 12 cylinder York machines with nested banks of cylinders, 3 1/4

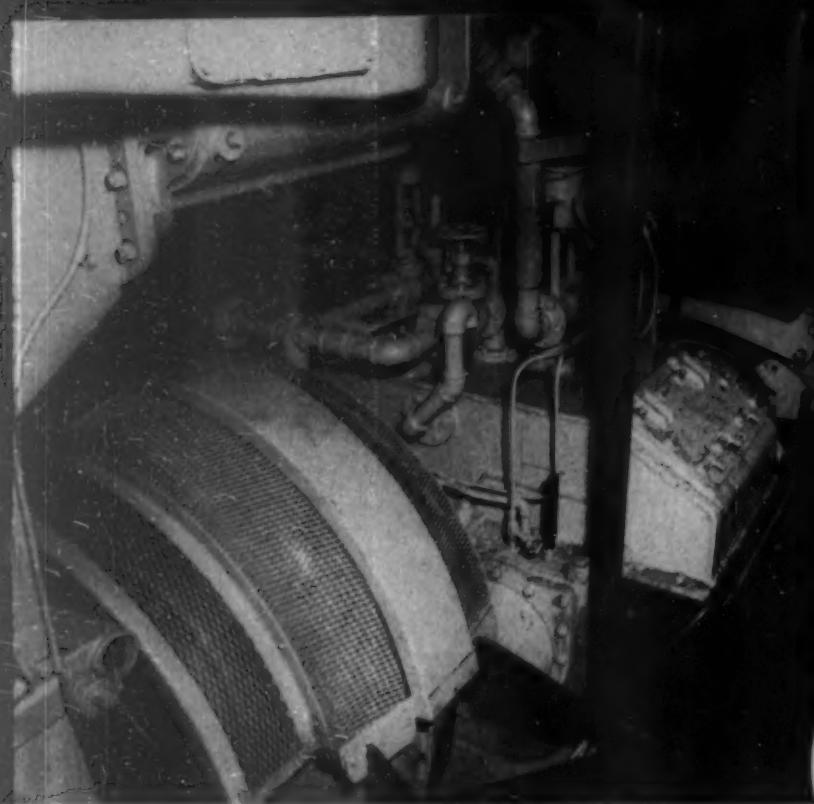
x 3 in. bore and stroke, each direct driven by an air starting General Motors model 671, 6 cylinder diesel. Besides that she has a 4-cylinder York refrigeration compressor driven by a 40 hp. Westinghouse motor. Her pumping layout is equally astounding, with sixteen 7 1/2 hp. FM powered Jacuzzi brine transfer pumps and a 7 1/2 hp. Jacuzzi salt water condensing circulating pump, besides fire, bilge and transfer pumps, two large condensers and 2 ammonia receivers. She packs two 18 ft. Western fairliners and 2 large skiffs on the top deck. The fairliners pack Chrysler 115 hp. gas engines.

Her main diesel is a 10 cylinder 8 1/4 x 10 in. OP Fairbanks, Morse diesel, developing 1800 hp. at 800 rpm., driving a Coolidge three bladed bronze propeller. The main diesel drives through an Amer-

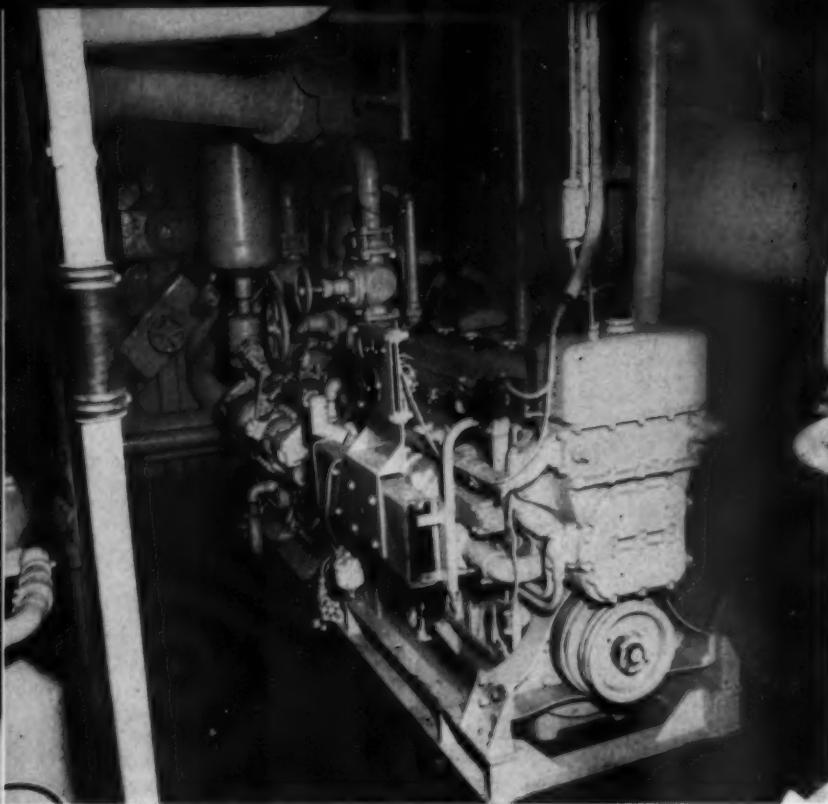
The *Western Ace*'s electric switchboard.

Another view of the GM Cleveland Division Model 268A generating set.





The Western Ace's hydraulic coupling.



The GM Detroit diesel Model 6-71 on 12-cylinder York refrigeration pump

ican Blower hydraulic coupling and a Westinghouse 2.261 to 1 reduction gear. Her auxiliary diesel layout, besides the 2 GM diesels for the direct drive refrigeration compressors, include a 60 kw. Fairbanks Morse 220-440 volt ac. generator driven by a GM model 671 diesel and two 100 kw. 450 volt ac. and a 20 kw. dc. 120 volt set for navigation equipment driven by two Model 268-A General Motors diesels. A 10 kw. Westinghouse ac-dc. converter set is also provided. The ingenious design eliminates all storage batteries.

Two Ingersoll Rand air compressors for starting the diesels are fitted; as well as large Hyde 25 hp. electric windlass. U. S. Motors are used on the 7½ hp. fire and bilge pumps. Elaborate CO₂ fire pro-

tection is fitted, including fourteen 50 lb. and ten 15 lb. tanks and 6 portable pump type extinguishers, plus many fire hose reels mounted on the walls. The galley is big enough to run a small hotel, with oil fired range, walk-in boxes, etc. The navigation equipment would suffice for an ocean liner, including Sperry automatic electric steer; Sperry repeating gyroscope compass with 3 stations; Fathometers; Raytheon radar; Northern radio; Clinometer, rudder angle indicator, rpm. indicator, etc.

Her normal operating speed is 12 knots and she averaged close to 11 knots on her maiden voyage from Tacoma to San Diego. Representing the owners was Hervey Petrich who, with his father Martin Petrich and his brothers, own the *Western*

Ace. Hervey Petrich took the ship south with the captain, Ralph McCabe, who will operate out of San Diego for the owners.

List of Equipment

Main Engine—10-cyl., Model 38D8½ OP engine, 1600 hp. Fairbanks-Morse.

Auxiliary engines—Two Model 3-268A, 100 kw. GM Cleveland Division. One Model 6-71 with 60 kw. and two Model 6-71 driving ice machine. GM Detroit Diesel Div.

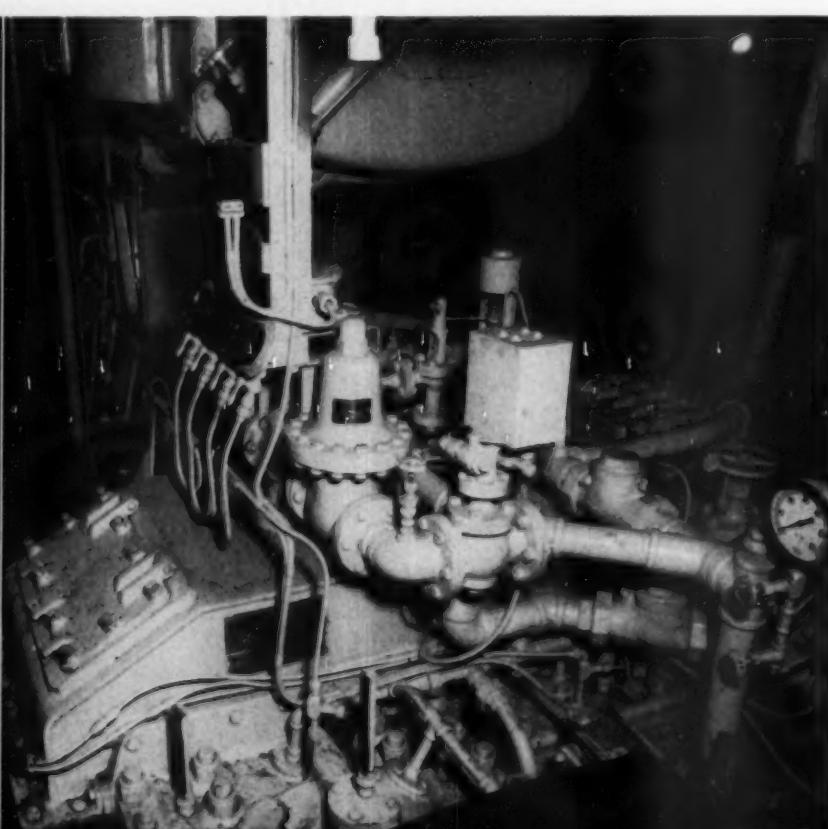
Air starters—Ingersoll Rand.

Mufflers—Kittell.

Oil filters—Oil Filter Service Co.

Heat exchangers—Ross.

The Westinghouse reduction gear on the Western Ace.



DIESEL ELECTRICS FOR THAILAND

EIGHTEEN of an order for thirty Davenport diesel-electric locomotives have been completed and shipped to far off Thailand (Siam) by Davenport Besler Corporation of Davenport, Iowa. These locomotives are of the 0-4-0 double truck type built for meter (39 $\frac{5}{8}$ in.) gauge, weigh 50 tons and are of 500 hp.

The Royal State Railways of Thailand employ these locomotives on passenger and express trains and for main line freight and switching service. The rail lines upon which these Davenports operate radiate out from Bangkok, the capital, to distances of over nine hundred kilometers. The engineering of these units required consideration of several service factors to be encountered in Thailand. Both the diesel engines and the electrical equipment needed to be adequate under climatic temperatures ranging up to 110° Fahrenheit and relative humidity which seldom departs from a range of 74% to 100%. The clearances encountered on the right of way are unusually small, thus, a very compact interior arrangement was required with adequate available work space for proper servicing of all equipment.

The speeds called for are up to 70 kilometers or approximately forty-three and a half miles per hour. To insure flexibility, these locomotives have

a driver's cab at one end and are equipped with multiple unit control so that they may be coupled together in pairs, to become a power unit of 100 tons and 1000 hp.—capable of hauling the maximum train permitted by coupler strength and other factors. When operating as single 50-ton units they are suited to somewhat lighter haulage without a waste of power. The body is streamlined for appearance and for minimum air resistance. Vacuum brakes are required for the cars but straight air brakes are used on the locomotive. The coupler is of a special screw hook arrangement built integral with a buffer.

The engine used is a supercharged "V" type with 12 cylinders of 5 $\frac{3}{4}$ in. bore by 8 in. stroke. This engine is rated 500 gross hp. at 1200 rpm. Each locomotive is furnished with one main generator; one exciter auxiliary generator unit; and four traction motors.

As explained previously, ingenuity was exercised in arranging adequate service work space in a necessarily compact arrangement—and accessibility was emphasized. For example, easy removal of the power unit is effected through a large hatchway (this hatch carries the mufflers) which can be removed from the top of the locomotive. All accessories, to conserve power, are driven by "V" belts

with simple adjustment provided to take up wear. One blower, located relatively near the center of the locomotive provides air for the traction motors.

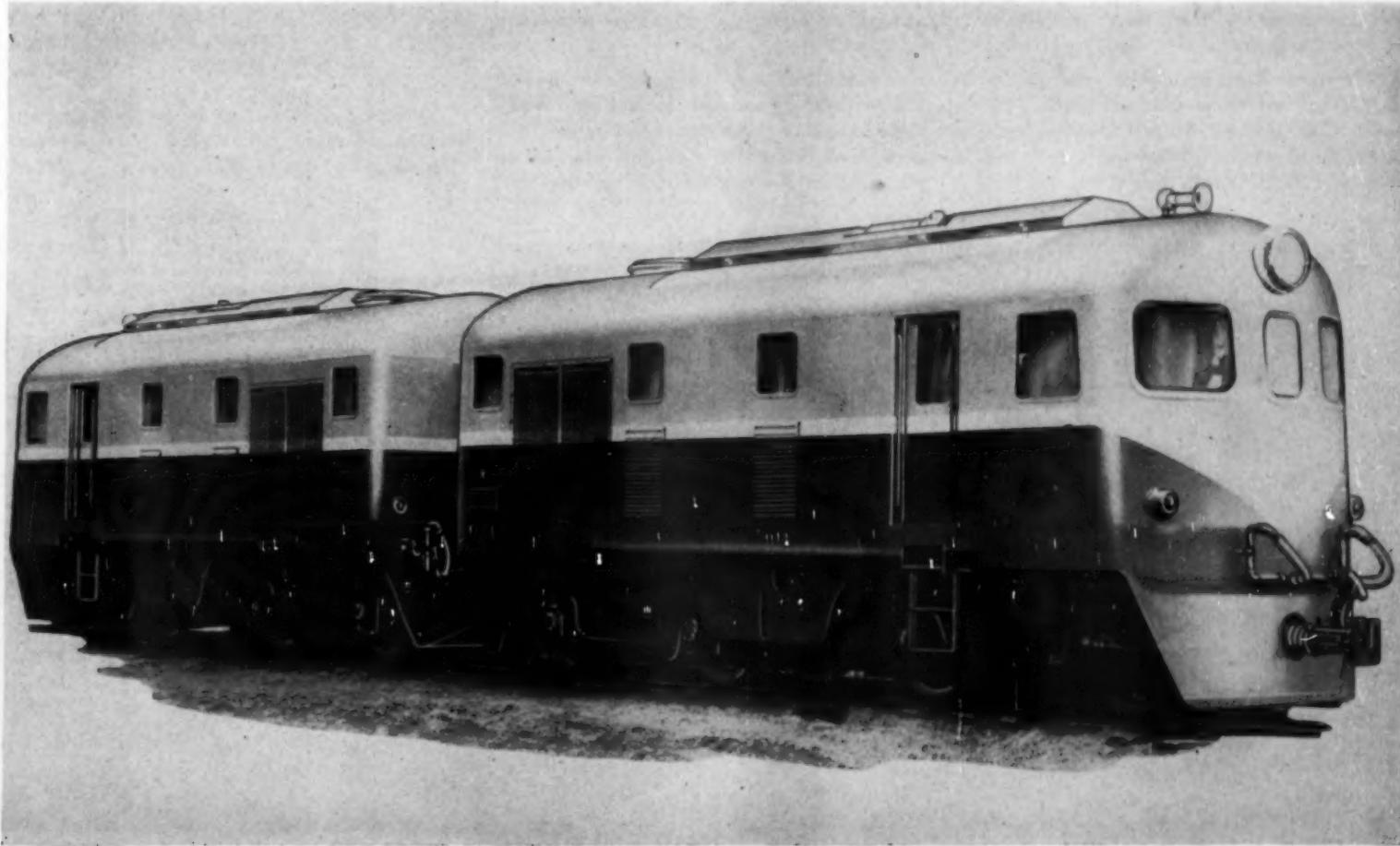
Radiators are located on each side of the locomotive and the cores are readily removable from the outside for repair. The radiator fan is "V" belt driven and mounted in the roof of the car.

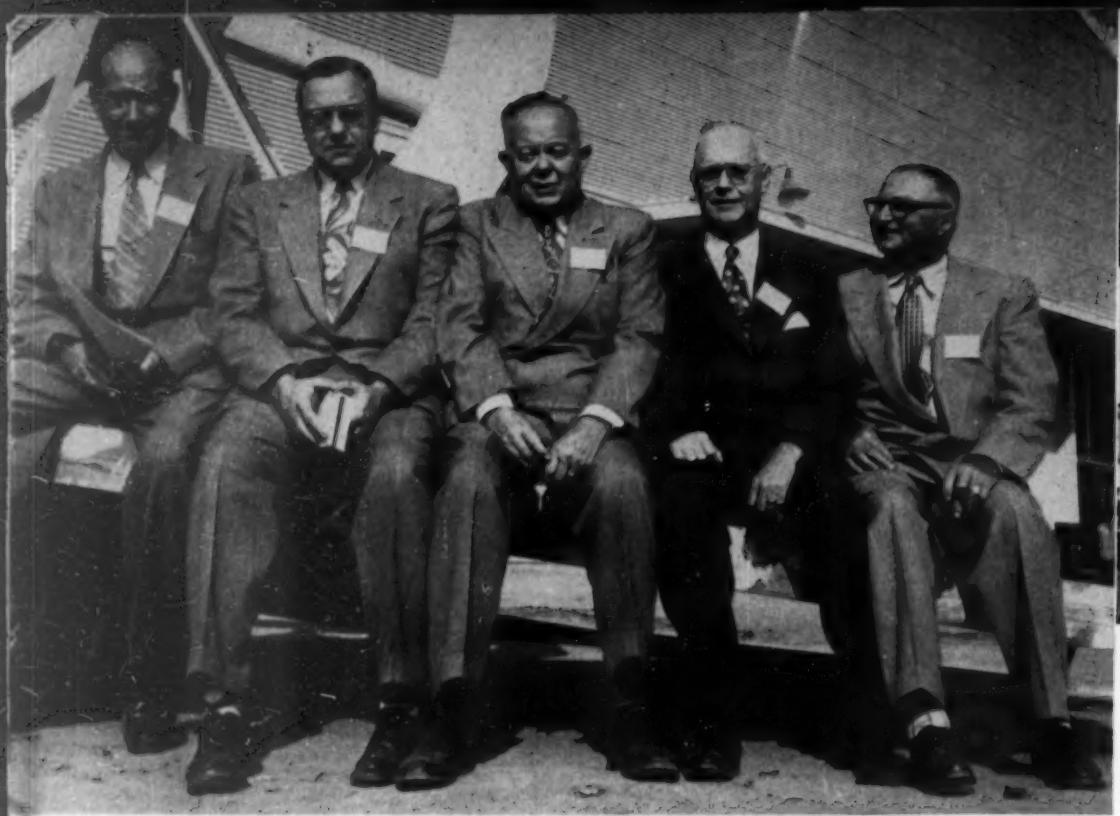
Individual cylinders are provided for the clasp brakes in order to simplify the mechanical arrangement. The use of a combined exhauster and compressor has furthered compactness and proven most satisfactory. All controls in the engineer's cab, including the control panel for the electrical equipment, are conveniently located.

List of Equipment

Engines and accessories—Caterpillar.
Blowers—American Blower.
Vacuum and Air Brake System—Westinghouse.
Electric and Traction Equipment and Control—Westinghouse.
Nickel Cadmium Battery—Nife.
Radiators—Modine.
Heat Exchanger—Ross.
Mufflers—Maxim.
Speed Recorder—Chicago Pneumatic Tool.

The diesel-electric locomotive which is being built by Davenport for Thailand. The Royal State Railways of Thailand employ these units for passenger, mainline freight and switching service.





At the Beltwide Cotton Conference: left to right, A. H. Dill, sales manager for Oliver's "Iron Age" line; E. G. Hacker, Oakland branch manager; A. W. Thompson, West Coast manager; William J. Fisher, vice-president of Oliver Corporation and Chairman of Board of the Farm Equipment Institute; Charles Elwood, Oliver Implement Co., Bakersfield dealer.

OLIVER STEPS UP FARM DIESELS

Factory and Branch Officials Study Western Trends in Cotton, Grain, Vegetables and Fruit to Plot Future Mechanization to Meet Demand

By F. HAL HIGGINS

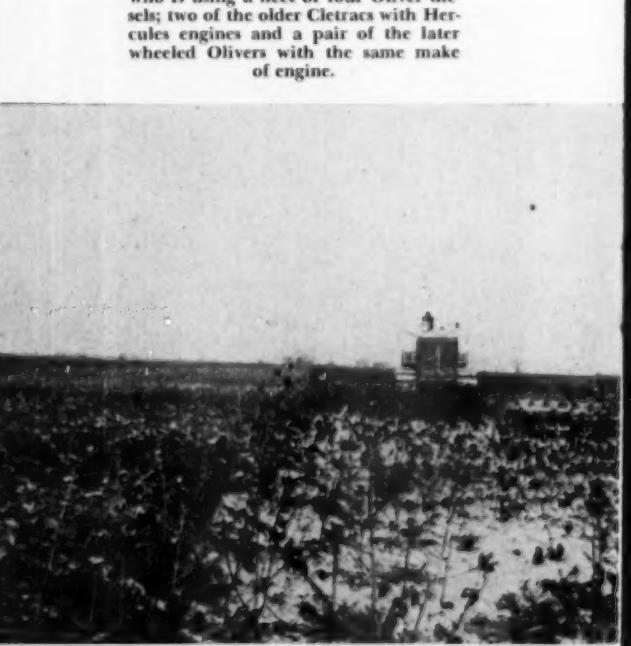
THE Oliver Corporation with head office in Chicago and factories in Springfield, Ohio; South Bend, Indiana; Battle Creek, Michigan; Charles City, Iowa; York, Pennsylvania, and Cleveland, Ohio, has come back from World War II in

a big way. Oliver has picked up the old Cleveland Tractor Company and more recently the century-plus Farquhar Company that has a long horse and steam power background in the threshing field before the later gas and dieselized farm machines

came into the field. The writer recently went out to hear one of the new Oliver factory-dealer huddles with some of the smaller manufacturers of special Western equipment. This is such a reversal of the old Eastern attitude toward West Coast farming, that it is noteworthy. The writer wanted to get a first-hand close-up and see what was going on, so he went to Merced, in the heart of the San Joaquin Valley, to visit with the Oliver group as they met at their dealer's place. This was Polzine's, and his guide ran me out to a big all-Oliver diesel rancher, Bright Nursery, to prove that this line of diesels is not only on the job but are winning friends and influencing people and crops.

"Oliver dieselized tractors are the only kind you will find on my ranch," replied the ranch owner, as we moved out to his fields to see a pair of

Polzine's service man visits a rancher who is using a fleet of four Oliver diesels; two of the older Cletracs with Hercules engines and a pair of the later wheeled Olivers with the same make of engine.





Oliver dealer's store in Bakersfield, capitol of California Cotton-Early Potato empire.

Planting cotton and cultivating at the same trip by an Oliver tractor near Merced, California.

Hercules-powered Cletracs disked down the dead cotton stalks preparing a seedbed for a new crop. Both tractors were rolling along in high gear as they disked down the stalks and chopped them into the soil for mulch, while spading up the ground.

In another field was an Oliver wheel type diesel tractor cultivating. The rancher had decided to take full advantage of diesel economy and make his cultivating tractors diesel as well as the crawlers on heavy seedbed work. The economies of diesel tractors on this ranch run in several directions reported by the owner: 1) cutting cost of fuel in half; (2) eliminating a fire hazard on the ranch; (3) cancelling "leakage" from lost gas to auto driving ranch help and passersby; (4) less cost for insurance against fires. At the ranch shop we found one of the two Oliver diesel wheel tractors standing

Oakland branch officials in a huddle with three dealers and their service-men studying a new attachment, the Thomas Vari-Draulic Drive.

Pair of Oliver Cletrac crawlers with Hercules engines disked down the old 1951 crop.

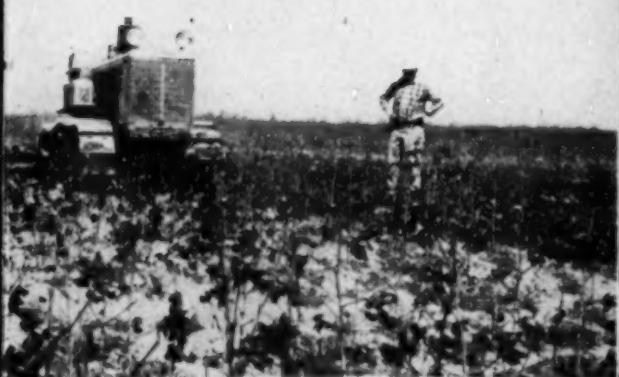


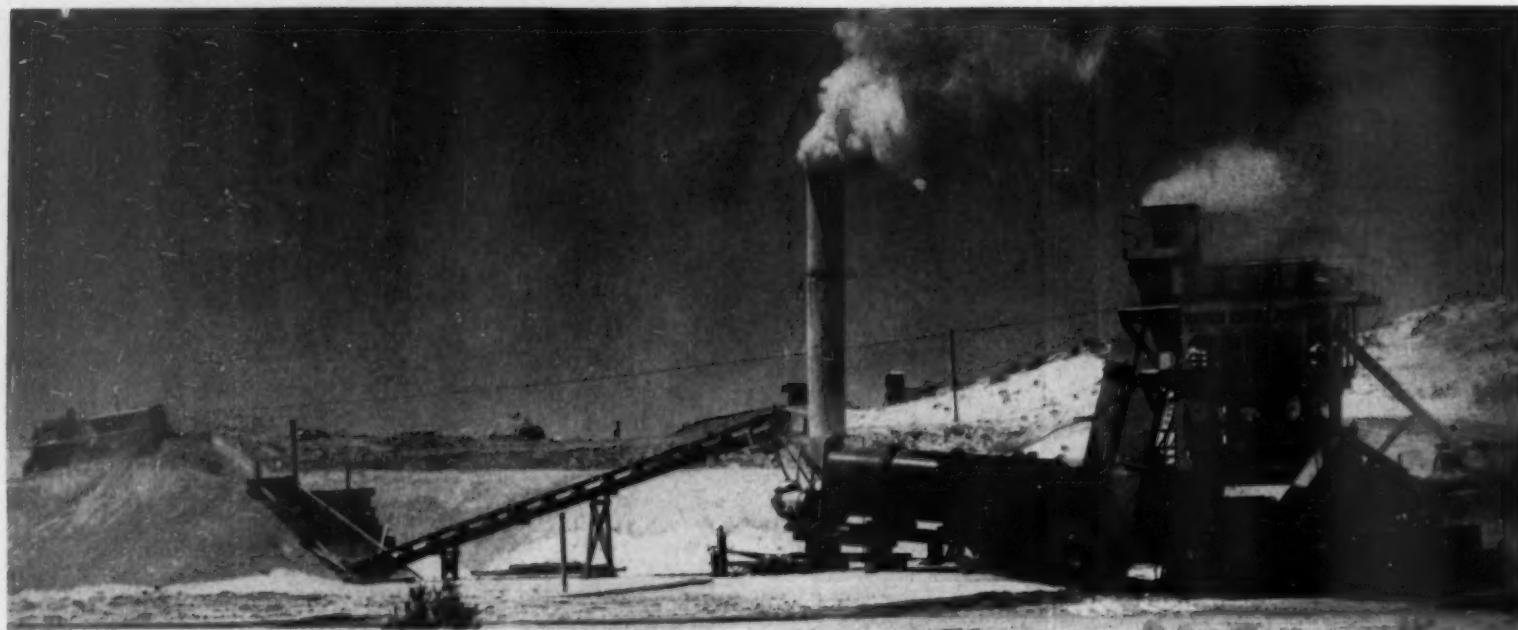
in a corner getting a battery recharging. Hence, it was the only one of the four Hercules dieselize tractors on this ranch not active at the moment, in the opening of the busy season.

Seen at the recent Beltwide Cotton Conference was a group of top Oliver men studying the trends as outlined in the mechanization program here. William J. Fisher, a top Oliver official from the Farquhar factory at Troy, Cal., gave the main address for the farm equipment industry. Mr. Fisher is also chairman of the board of the Farm Equipment Institute, which is the industry's national organization. Said Fisher just before he posed with officials from other Oliver branches, "Today in the 14 major cotton states, over 1,250,000 tractors are doing the heavy labor of men and mules of a few years ago. In addition, a multitude of other cotton equipment is increasing one man's ability to handle large cotton acreages. Arizona and California

offer the most striking and significant figures on what is happening in cotton mechanization that other areas must follow. Only 9% of Arizona's cotton was harvested by machine in 1950. In 1951 that percentage rose to 26. In California machines picked 34% of the crop in 1950 and went up to 53% in 1951.

"Cost of picking by machine was \$14.65 of which about half was for overhead and amortization. Hand picking cost \$34.63 for the same season." The California Oliver men were busy pointing out to their Eastern officials that California-Arizona cotton farming as well as all other branches of agriculture is going dieselize as fast as the factories can turn out the engines to make it possible. Over half the International tractors carrying pickers were diesel in California in 1952. So, the Oliver dealer advisory groups are being set up in all areas with good results already showing.





Madsen asphalt plant in operation. Note diesel tractor at far left pushing crushed rock into collecting bin. Diesel plant is at right.

UNIQUE DIESELIZED PACKAGE CUTS COSTS ON ASPHALT BATCH PLANT

By FRED M. BURT

DIESEL engines have come to be recognized as the most efficient and economical units for use in powering batch type plants for supplying asphalt concrete extensively used in roadbuilding, for lining reservoirs, at airports, etc. These are plants that can be set up at convenient supply points; and, when indicated, be moved and re-erected at other locations. One of the most prominent manufacturers of these plants in the Far West is the Madsen Iron Works, Inc., of Huntington Park, California. This company produces these plants, completely equipped, of different capacities, and designed for the most efficient and economical operation to suit the specific requirements of the customer contractor.

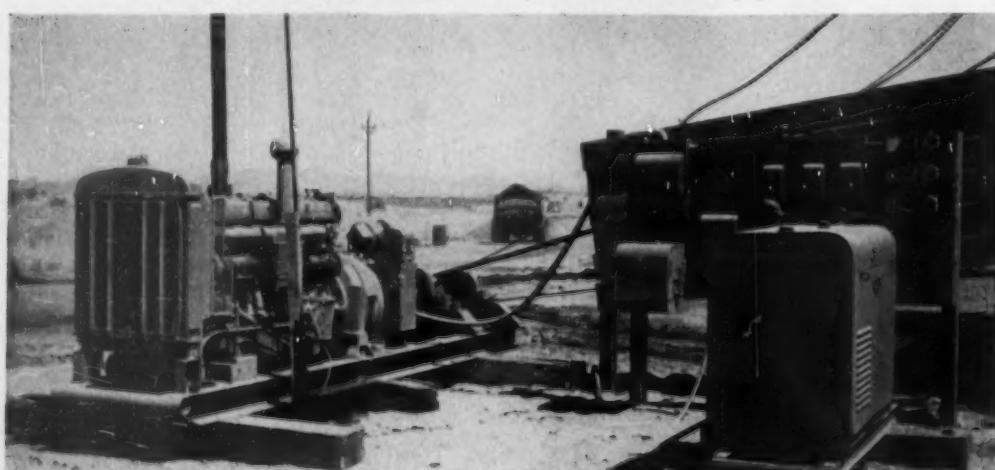
The diesel-electric and direct drive combination designed and supplied by Emil Riutta's Engine

Sales & Service, Los Angeles, (distributors also for P&H, Sheppard, Witte, & Enterprise diesel engines) to power a Madsen, 3,000-pound batch type plant, shows how fully adequate power can be supplied with minimum equipment and operating costs. The plant was built for Tanner-Heuser-Garnett, Los Angeles contractors, to be used first on a roadbuilding job near Yuma, Arizona. The main power unit, a 6-cyl. 165-hp. Murphy diesel engine, is direct-connected to a 75-kw. Electric Machinery generator. The drive shaft extends through the generator to provide a direct belt drive to the plant mixing unit, through the medium of a line clutch. The plant mixing unit consists of the hot stone elevator, vibrating screen, pressure injection system, and the twin-shaft pugmill mixer. Electric power is used to revolve the 72 inch diameter x 20 foot long dryer, for the 60 foot long belt conveyor

that carries crushed stone to the dryer and the feed tunnel equipped with a single reciprocating plate feeder, and also to the 2½ inch asphalt pump, the 1¼ inch dryer fuel pump, and the Clayton steam generator which takes care of the steam atomizing dryer burner, the mixer cylinder, various steam jackets, and the stack jet. Electric motors involved: Geared to dryer, and with speed reduction chain drive to conveyor belt—40 hp., Steam generator—5 hp., Asphalt pump—7½ hp., and Fuel pump—3 hp.

An additional 75 hp. electric motor would be required for the mixing unit if it were not driven from the shaft. The greatest power output requirement comes from the starting of the pugmill mixer, after which other power demands can be placed on the generator, and when much less power is required for the pugmill. If the 75 hp. motor was added to the electric power demands, a 150 kw. generator, with a much larger diesel engine, would be required. This would have nearly doubled the power plant cost. This power combination represents a saving of about \$5,000 over the more orthodox installation in original investment, plus subsequent savings in operating and in maintenance/overhaul costs. An auxiliary 20 kw. generator (powered with a 57-hp. Chrysler industrial engine) is available for night operations (lights, operation of asphalt pumps for unloading, and Clayton steam generator). It should be noted that the whole power plant unit is assembled as a single package, rigidly mounted on an I-beam skid frame, to add ease of portability. The whole asphalt plant is designed as a "legal" unit; that is, it can be disassembled for highway truck transportation without any truck load exceeding legal limits to weight or dimensions.

At left, complete power package, skid mounted for portability. 165 hp. Murphy diesel, 75 kw. Electric Machinery generator. At right, a skid mounted auxiliary 20 kw. generating set. In the background is the Westinghouse control and switch equipment.



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• "I run a tugboat fleet and it's diesels for me!"—"I'll take diesels for my trucks!"—"In my power plant, I count on diesels!"

Every diesel user has his preference of make. But, no matter which of the fine diesels above he chooses, chances are it's protected with Air-Maze air or liquid filters. That's because diesel manufacturers know Air-Maze filters mean complete protection whether they're on an intake, in a lube system, in a fuel system or at any other danger spot. Engines, large or small, last longer, work better,

require less maintenance when they're protected with Air-Maze filters.

With a background of twenty-eight years' experience and thousands of applications, Air-Maze, the filter engineers, have met practically every diesel filtration and silencing need. Air-Maze serves the industry with a complete line of intake silencers, fuel filters, lube oil strainers and other products. For help with your filter problems, contact your nearby Air-Maze representative or write The Air-Maze Corporation, Cleveland 28, Ohio.

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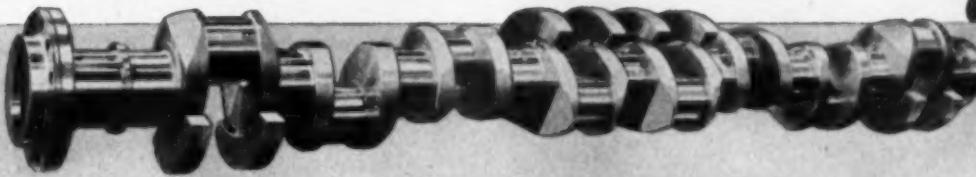
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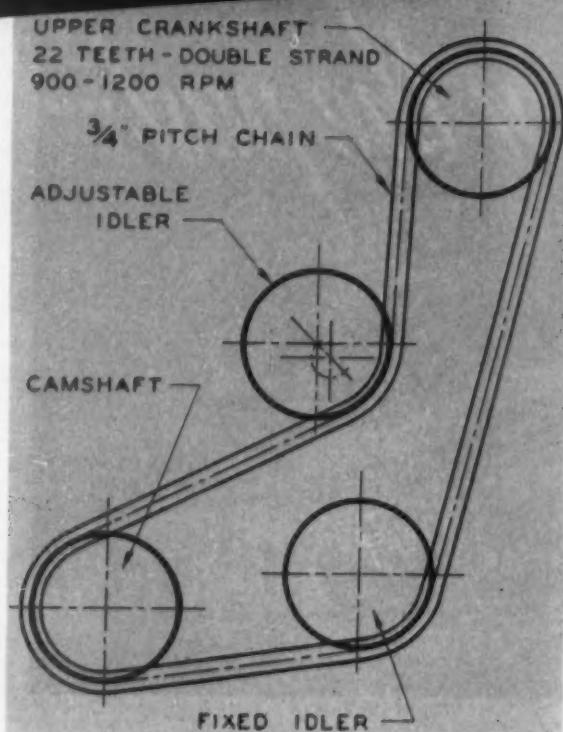
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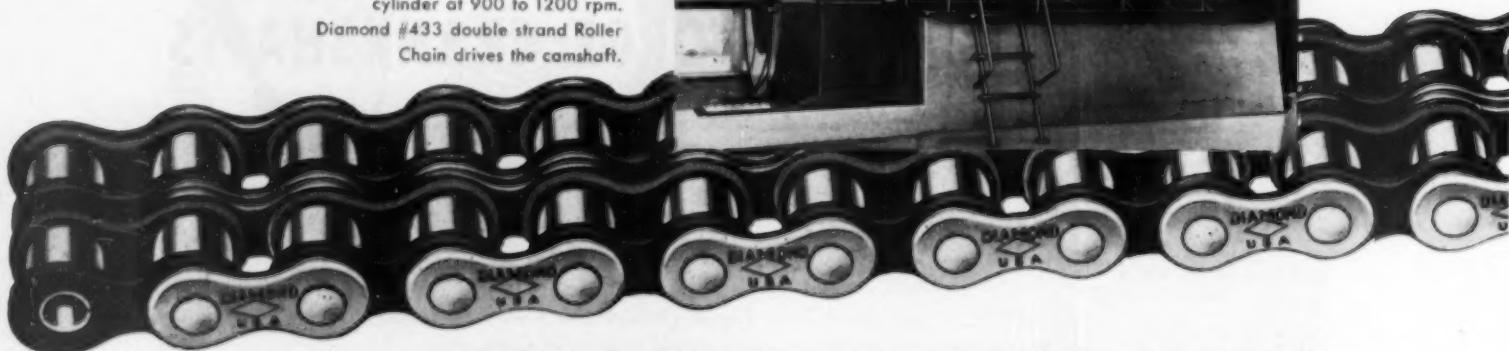
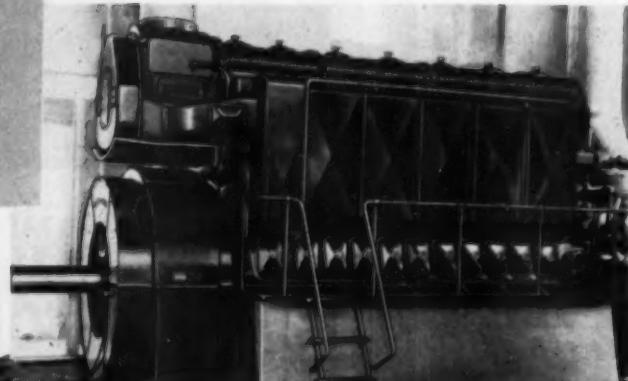


ON THE NEW O-P FAIRBANKS-MORSE ENGINES



The new, O-P Fairbanks-Morse Engine, $5\frac{1}{4} \times 7\frac{1}{4}$, is rated 75 hp per cylinder at 900 to 1200 rpm. Diamond #433 double strand Roller Chain drives the camshaft.

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◆ In developing their O-P engine for commercial use, Fairbanks-Morse demanded the highest quality in every component to assure efficient, dependable performance.

Because of their well-established advantages and uniform high quality, Diamond Roller Chains were selected for the drive from crankshaft to camshaft... With Diamond Roller Chains, long or short shaft center distances are readily accommodated. Diamond Roller Chains operate from either or both faces. They drive one or many shafts in the same or opposite directions from one power source and without slip. Separating forces on bearings are elimi-

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The wide and long use of Diamond Roller Chains by leading engine builders for timing, pump and power take-off drives testifies to the extra values you will find only in the chain that bears the Diamond trade mark.

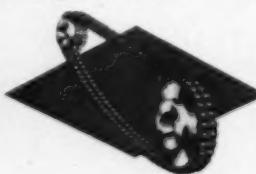
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DIAMOND



ROLLER CHAINS

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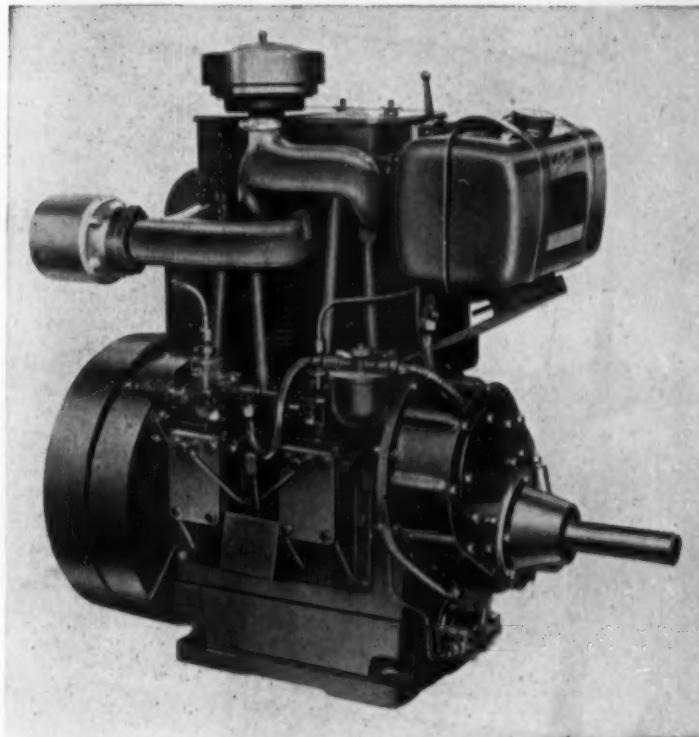


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To Exhibit at International Petroleum Exposition

Heat transfer products for the petroleum industry, manufactured by Young Radiator Company of Racine, Wis., will be displayed at booths 67 and 68 in the Scientific and Technical Bldg. at the International Petroleum Exposition to be held at Tulsa, Oklahoma, May 14-23. To be exhibited by Young Radiator Company are heat transfer products specially designed for use in refineries and field processing of gas and oil. They include:

Stamped tank sheet metal radiator designed for gas or diesel prime mover installations; motor-type cast tank radiator; "Mono-Weld" sectional radiator for heavy-duty gas, gasoline and diesel engine cooling; Jacket Water Cooler for jacket water and fluid cooling of diesel, gas, gasoline engines; shell and tube heat exchanger for lube oil and engine jacket water cooling; "OSH" unit oil cooler with patented turbulator for cooling lube oil; "Verti-flow" unit heater for all applications requiring direct, downward distribution of heated air; gas-fired unit heater with aluminized steel combustion and heat exchanger, adapted for use with mixed, natural or liquefied petroleum gases; a typical blast coil for central plant heating, ventilating and air conditioning; and also a water coil for cold water cooling systems.

Danish Cargo Ship Launched

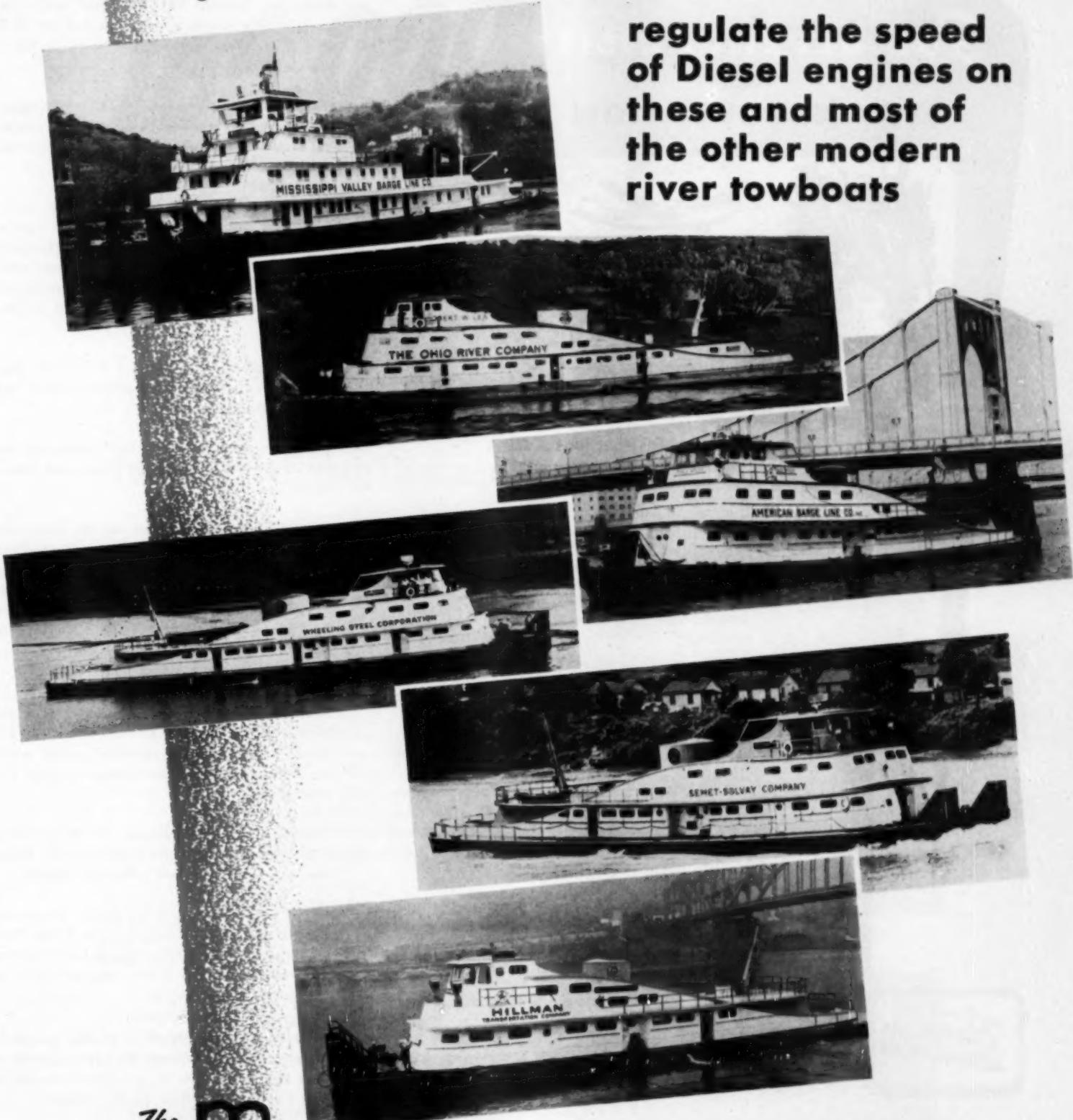


Shown on her trial run is the motorship *Songkhla* which was recently launched at the Burmeister & Wain shipyard in Copenhagen, Denmark. Built for the East-Asiatic Company Ltd. of Copenhagen, she has a length of approximately 456 ft. between perpendiculars and a beam of approximately 62½ ft. She has a deadweight of about 10,100 tons and her speed on loaded trials was about 16.8 knots.

The main propulsion unit is a single B & W, direct reversible, single acting, poppet-valve, two stroke, 7-cylinder crosshead diesel with turbocharger. In normal continuous service it is capable of developing 8750 bhp. corresponding to 9870 ihp. at 115 rpm. This is an increase of 35% in bhp. as compared to the non-turbocharged engine. The cylinders have a bore of 740 mm. and a stroke of 1600 mm. The auxiliaries consist of three single-acting, four-stroke, 4-cylinder, trunk-piston diesels, each coupled direct to a dc. generator capable of yielding 120 kw. at 220 volts.

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Florida Diesel News

By ED DENNIS

RECENT Murphy powered additions to the shrimp fleet were the 70 ft. *Gulf Star* with a 165 hp. Murphy diesel, for the Hardin Fish Co., and the *J. P. McKenzie* and the *A. M. Strom* for Capt. Jack Carinhas.

FROM Tampa we hear that the General Engine & Equipment Co. repowered a dragline with a General Motors 4-71 diesel engine for J. W. Connors & Sons of Fort Myers.

DIESEL Engine Sales Co. has enlarged their facilities at their Fort Myers branch shipyard to include a new machine shop, engine overhaul shop and new and longer marine ways. These additions were needed due to the ever increasing number of trawlers being berthed on the Gulf Coast of Florida.

FOR THE Haytian Tractor & Equipment Co., Port-au-Prince, Haiti: a D 8 Caterpillar tractor and a #12 Caterpillar grader.

TWO General Motors 2-71 diesel generating sets with Delco 20 kw. generators, Fulfilo fuel filters, for the *Stella Polaris*.

DESIGNED for the Campeche run, the *Lady Belle* is powered with a D 337 Caterpillar diesel, Twin Disc power take-off, Snow Nabstedt 4:1 reduction gears; fuel consumption is 9.5 gals. per hour, the 3 kw. Onan diesel generating set also drives a Jabsco bilge pump. Other trawlers in the fleet are the *Dolores D* and the *Dickey Boy* with 275 hp. GMs; owned by Dickey Seafoods of Tampa.

A HALLETT 5 hp. diesel auxiliary set for the *West Wind*. The main engine is a GM model 110 diesel, Jabsco and Fairbanks-Morse pumps; this is the ninth addition to the Sahlman Seafood Co. trawler fleet.

FOR Cayenne, French Guiana, an 18 kw. Caterpillar generating set with a Louis Allis Co. generator, for emergency power at the local airfield.

BALD Eagle Construction Co. of Fort Lauderdale received another D 6 Caterpillar tractor from Shelley Tractor & Equipment Co., of Coral Gables. They also delivered a D 8 Caterpillar tractor to Troup Bros. of Miami.

CUMMINS Diesel Engines of Florida announces the appointment of George Wickwire, formerly of their Miami branch to the position of manager of sales and service at their Tampa branch.

CUMMINS powered are the Euclid trucks for the Miami Crush Stone Co. Three 13 yd. trucks have 160 hp. diesel engines and two 12 yd. trucks have 150 hp. diesel engines.

REPOWERED at the docks of Cleveland Diesel Div. GM, Miami: the Key West trawler *Bill Adams*, with a 275 hp. General Motors 110, also GM hydraulic clutch and 3:1 reduction gears.

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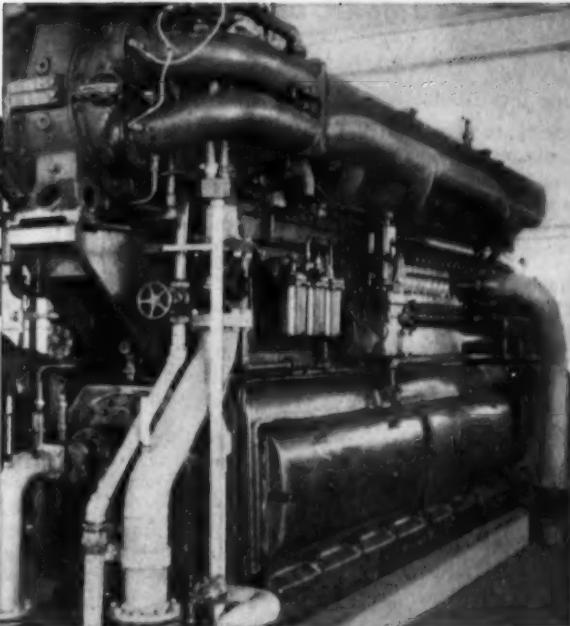
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completed by 28 Alco Diesels
at 98½% availability**

for Gulf Refining Company



Twenty-two years ago, Gulf Refining Company installed 28 Alco Diesel Engines on its new, 700-mile Tulsa-to-Spencerville Junction pipeline. Today, those 28 Alco Diesels have completed more than 165,000 hours of service and are operating at 98½% availability. And since 1941, when the output of the line was greatly increased, they have been in actual service an average of 97% of the time.

Pumping station superintendents throughout the United States and Canada specify Alco Standardized Diesels because of this kind of *proved* dependability—and because of these economy features:

- **Compactness**—for lower construction costs
- **Higher Engine Efficiency**—for lower fuel costs
- **Medium Speed**—for lower auxiliary equipment costs
- **Flexible Power Range**—for lower expansion costs

For the complete story on Alco Diesel Engines, contact your nearest American Locomotive Company Sales Office. You will find them in New York, Beaumont, Chicago, Cleveland, Houston, Kansas City, San Francisco, Schenectady and St. Louis.



Cummins Sales and Service Expands



Scheduled for completion this month, the Los Angeles plant of Cummins Service and Sales has been remodeled and enlarged in order to give the fastest and most efficient service on engine rebuilding, repairs and parts. A completely new building has been added where engines are rebuilt on a production line basis. The floor space devoted to this department has been increased, and additional me-

chanics hired to increase production more than 20%, according to Ken Rush, Service Manager. Another new building has been added to house a double-end dynamometer which permits one engine to be tested while another is being worked on.

The entire repair department has been reorganized to permit the greatest possible efficiency and supervision of the 47 mechanics on duty. The repair "apron" and service parking area have been enlarged so that equipment needed not be moved to allow a finished truck to be driven away. A second shift has been inaugurated to take care of emergency night work. A drivers' lounge has been added, as has a service sales office where repair orders are written up quickly to save customers

time. The parts department also has been reorganized in a more convenient location for customers, and a new parts center and parts lobby installed. A parking area is now provided for pickup trucks calling for parts. Cash is sent to the accounting office through a vacuum tube system which permits an enlarged center staff to wait on customers promptly.

The parts inventory has been increased to the point that Cummins Service and Sales maintains a supply of more than 7,500 different parts, the largest stock of Cummins parts in the world with the exception of the Cummins factory, according to Gene Power, parts manager. The new accounting office is located in the central section of the main building and is connected with all other departments by inter-communication telephone and to the parts and repair departments by vacuum tubes. This permits time and material charges to be accumulated each day so that customers may obtain their invoices without delay. Copies of all work sheets are made on a reproduction machine which eliminates errors in copying and permits the customer to have an exact copy bearing his signature. Electrically-operated inventory-control cards speed up ordering of parts from the factory.

OUTBOARD PROPULSION CAN SAVE YOU MONEY

**Compare the Money-Saving Performance of the
HARBORMASTER Outboard Unit in the Marine Industry
Before You Build, or Before You Re-power**

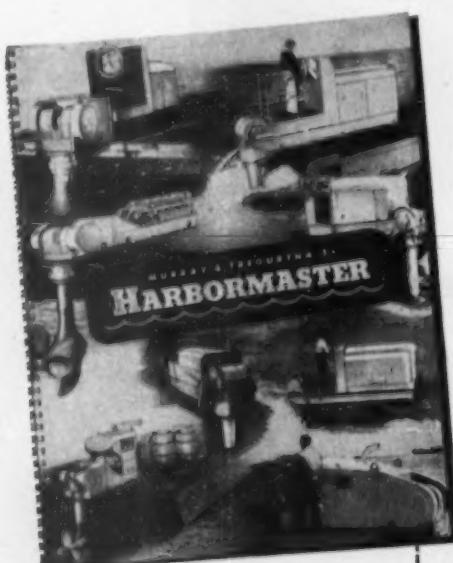
IT will pay you to investigate the advantages of *outboard* power the very next time marine motors are up for discussion.

The Harbormaster Outboard Propulsion and Steering Unit brings powering of barges, towboats, tugs, lighters, derricks, ferries, etc. to a new high peak of efficiency. Hundreds of these heavy duty units are in daily operation. Operators are saving thousands of dollars in many marine applications because of the natural advantages of outboard propulsion.

How fast can you get there, and how much pay load can you carry? These are the questions you need to have answered, and in the great majority of cases you will find the best answer in the Harbormaster. You get the ultimate in maneuverability with Harbormaster, which allows you to steer instantly with full power in any direction, through the patented M&T 360° Propeller Thrust Steering Control. You get tremendous savings in fuel expense because you have more thrust per horsepower.

Important features that save time and money include exclusive 180° Elevating Mechanism which allows 1-man operator to easily maintain and service the equipment; and Patented Shear Pin, which automatically shears off should underwater assembly strike a submerged obstacle, thus opening up vast new shallow water fields to continuous, reliable operation. Harbormaster models, for all marine purposes, are available in sizes from 20 to 300 h.p. engines, gas or diesel power.

You'll find this data, and further valuable information, in our comprehensive catalog containing over 70 photos and diagrams. Gladly sent you on request, whether you have immediate or future use for Harbormaster units. Why not write for the catalog now so that you will have full information on file?



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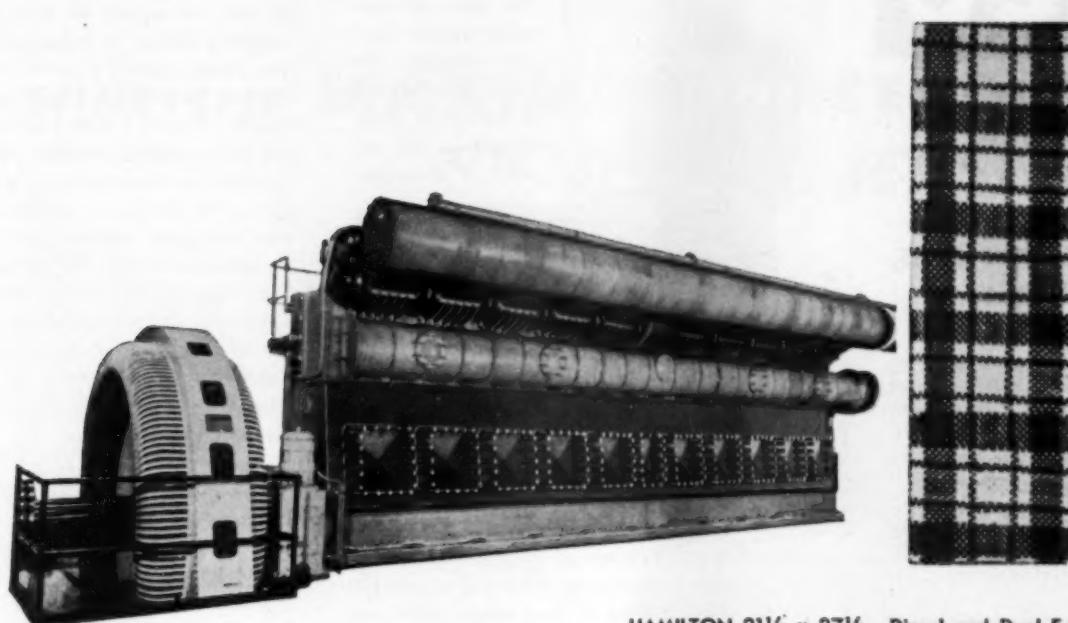
Name _____
Company _____
Address _____

Manager of Detroit Plant

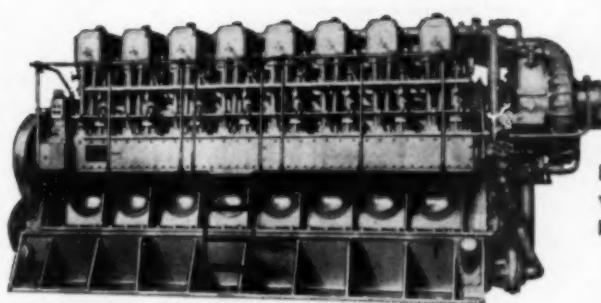


James C. Morrison

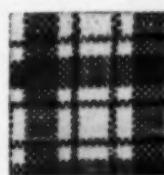
James C. Morrison has been appointed manager of Federal-Mogul Corporation's Detroit plant, it was announced by M. A. Hunter, vice president, manufacturing. He succeeds P. J. Potter who has requested an extended leave-of-absence for health reasons. Mr. Morrison was formerly an assistant to Hunter on the company's central manufacturing staff. He acquired broad experience in manufacturing management while serving as an industrial engineering consultant for the firm of Ernst & Ernst for five years. In this capacity his assignments included plant management, installation of wage payment and job evaluation plans, and dealing with manufacturing methods, plant layout, and production control problems for several industrial concerns throughout the country. Mr. Morrison first became associated with Federal Mogul in 1950 when he supervised installation of a standard hour wage payment at the Detroit plant.



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For more facts about these thrifty, dependable B-L-H Diesels, please be sure to visit us in our booth (#22) at the ASME Oil & Gas Power Conference, Schroeder Hotel, May 25-28, or write us for our latest Booklets on our Diesel Engines.



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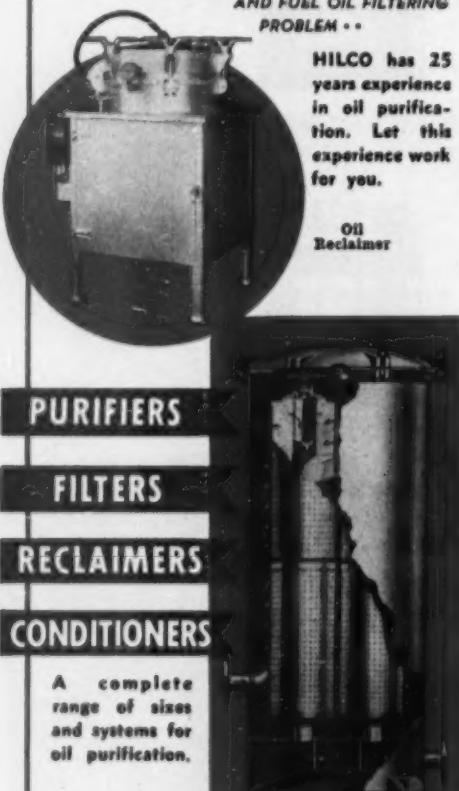
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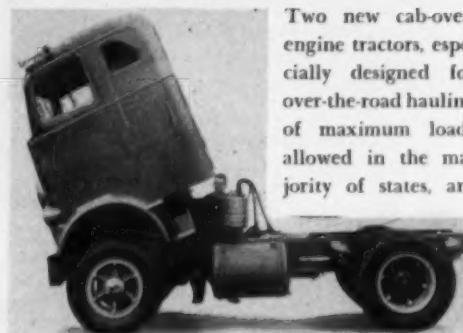
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Cab-Over-Engine Tractors



Two new cab-over-engine tractors, especially designed for over-the-road hauling of maximum loads allowed in the majority of states, are

announced by Mack Trucks. Added power and significant reduction in chassis weight without any sacrifice of strength have been employed, says Mack, to permit the greatest possible percentage of permissible GCW to be made up of payload. In addition, the tractors are so designed that they can accommodate 35-foot trailers and still remain well within a 45-foot overall length limit. In these latest models the company is offering a powerful answer to the problem of fixed weight limits and ever-increasing operation costs.

Designated as Models H60T and H61T, these two new tractors differ only in their respective power plants. The H60T is powered by a Mack Thermodyne gasoline engine, producing 170 horsepower at 2800 rpm. Motive power for the H61T is furnished by a Mack Thermodyne diesel engine delivering 170 horsepower at 2100 rpm. An air starter for quick engine response in cold weather is offered on this diesel. For those operations demanding greater horsepower than is provided with the Mack Thermodyne diesel engine, the Model H61T has the Cummins NHB diesel engine as an option.

An outstanding feature of both new models is the full-tilt, three-man cab. Placed directly above the power plant, the cab can be tilted forward manually in less than two minutes. Thus, the entire power plant is quickly and readily accessible for inspection and maintenance. All sheet metal, such as fenders and skirting, are attached directly to the cab and move with it when it is tilted. Demountable instrument panel is designed to permit instrument connections to be reached in minimum time and with least effort.

In exhaustive tests, says Mack, these new tractors have demonstrated exceptional performance ability which is attributed to the combination of ample power and a comprehensive range of ratios to meet varying operating requirements. Transmissions of both direct and over-gear types, affording five and ten speeds and auxiliary transmissions, are available in these models.

In summing up its latest models, Mack stresses the extra payload made possible by the cab-over-engine design and important weight-saving. These tractors are 1,000 pounds lighter than conventional cab-over-engine chassis of similar specifications and offer a commensurate increase in cargo weight. Weight-saving has been achieved through revision of design and liberal use of lighter metals, but, Mack particularly emphasizes, there has been no sacrifice of strength or durability.

Opens West Coast Factory Branch

In order to expand its West Coast service, the Automatic Switch Company (ASCO) of Orange, New Jersey, opened a factory branch April 15 at 923 East Third Street, Los Angeles 13, Calif. This branch will stock a wide variety of solenoid valves and electromagnetic control, and will function as the ASCO west coast service center. Overnight shipment to San Francisco, and two-day delivery to any west coast point is anticipated. Trained engineering personnel will provide electrical control "know-how," and backed by this large stock of control equipment, can supply "short notice" servicing to ASCO installations in Los Angeles and Southern California. Naturally, they will be in a position to assist other ASCO representatives in the west if necessary.

Automatic Switch Company engineers have been designers of electromagnetic control equipment since 1888, and of solenoid valves since the turn of the century. The company has pioneered in the development and manufacture of many designs and is today recognized as an authority on, and leading manufacturer of, solenoid valves, automatic transfer switches, remote control switches, contactors, relays, solenoids, and complete control panels. The extensive list of solenoid valves manufactured include two, three, and four-way valves, safety shut-off and manual reset valves, packed and packless valves, general purpose valves, and valves engineered for specific applications. Valves are designed for control of all types of fluids including among others, air, gas, water, steam, oils, and corrosive or non-corrosive liquids of every variety.



Frank E. Reeves

Mr. Frank E. Reeves, registered P.E. (New York, Massachusetts, Louisiana, and Mississippi), has been chosen to head the Los Angeles sales engineering organization. Mr. Reeves has a strong background in both the power and control fields. He has been associated with consulting engineering firms, utilities, and industrial companies as an electrical design engineer, and has had experience with all types of control problems. Mr. Reeves was chief coordinating electrical engineer in the design of an 80,000 kw. hydroelectric plant for Brazil, and of a 100,000 kw. steam electric generating station at Trombay, India. For the past several years he has been devoting his efforts to the electrical control field and has become a well-known authority on this subject. He is the author of over fifty articles on electrical control and associated subjects, and his book "Manual of Electrical Control" is used by many control engineers. He and his staff are capable of giving "on-the-spot" technical information, and have the ability to design control systems for every type of installation.



DIESEL PROGRESS

NINETEEN MAXIM SILENCERS ON THIS RAM JET STAND



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UNITED AIRCRAFT in East Hartford runs this laboratory for ram jet testing so quietly that its operation can scarcely be heard at a distance of 100 yards. Maxim Silencers, *19 in all*, effectively silence exhaust and intake of engines, compressors, and ram jet exhaust. For the solution to unusual silencing problems, consult Maxim, the company unequalled in silencing experience.



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Elected to Board of Directors



Maurice G. Cummings, of Houston, Texas, a vice president of The National Supply Co., has been elected to its board of directors. Mr. Cummings, who is widely known throughout the petroleum industry, joined The National Supply Co. in 1940 as vice president in charge of its

Texas Division. Growth of that division required it to be divided in 1951 into the Gulf Coast Division, with headquarters in Houston, and Southwest

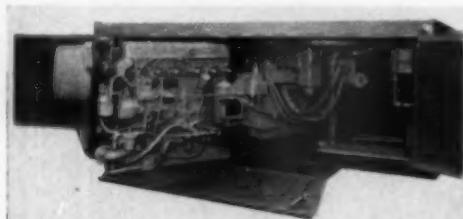
Division, with headquarters at Fort Worth, both under Mr. Cummings' supervision. Born in Beeville, Texas, Mr. Cummings attended public schools in Houston, and later attended Southwestern University, at Georgetown, Texas, and the University of the South, at Sewanee, Tenn.

His first work in the oil business was as a mule Skinner for J. S. Abercrombie in the Goose Creek oil field about 1919. Later he was in charge of warehouses for Gulf Coast Oil Corp., in Houston, and from 1926 to 1930 was in charge of accounting, warehouses, and purchasing for Vacuum Oil Co.

From 1930 until 1933 Mr. Cummings was in the purchasing department of the Magnolia Petroleum

Co. in Dallas. From 1933 until he joined The National Supply Co., he was in the pipe business for his own account in Houston. Mr. Cummings is a member of the Bayou Club, the Tejas Club, Ramada Club, and the Houston Club, and is a director of the City National Bank of Houston.

New Type Ambulance RR Car



The U. S. Army is testing a new type of ambulance railroad car which will be used to transport wounded soldiers from port hospitals to hospitals nearest their homes. Capable of sustained and independent operation, this car is being built by a midwest manufacturer with electrical equipment supplied by the General Electric Company and powered by a Buda diesel. The independent operation, which is the outstanding feature of this new car, is made possible by two diesel-electric undercar power plants.

Rated at 30 kilowatts each, the two power plants generate electricity for cooking, refrigeration, air-conditioning and heating. These unusual electric loads require approximately 50 kilowatts per car. A 50-horsepower Buda diesel engine is the prime mover of each unit. It drives a GE 220 volt alternating current 60 cycle alternator which, in turn, generates the electric power for the car. Each car has an automatic load control system to start and stop the power plants according to load level whether the car is operated as a single car or in a series of cars utilizing the permanent trainline connections. Rubber mounting of the engine-alternator set reduces vibrations in the car.

Cooper-Bessemer Promotes Seven

Seven promotions to key plant operating positions in its Mount Vernon and Grove City plants have been announced by Gordon Lefebvre, president of The Cooper-Bessemer Corporation. Tom McMichan, works manager, and Frank Stevenson, assistant works manager, of the Grove City plant, have been appointed special assistants to the president and will now be stationed at the headquarter plant in Mount Vernon, Ohio. Mr. McMichan's responsibility will be to coordinate tooling and production methods between the two engine and compressor building plants. Mr. Stevenson will be responsible for determining what production parts should be manufactured at each plant or purchased from outside sources.

Willard Luli, formerly production manager, has been named works manager at Grove City. Hugh Stevenson, formerly superintendent, is now assistant works manager. In other promotions made public at the same time, Ken Martin has been appointed as production manager, Guy Gahagan, general superintendent, and Clarence Evans, shop superintendent, day shift, at Grove City.



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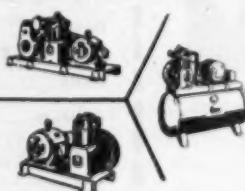


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Rich Salvage for Shrimper

The shrimp trawler *Spot Pack* headed for her home port of Miami with only 10,000 lbs. of frozen shrimp, but lashed to her sides were two prize vessels. Aiding the *Spot Pack* in shepherding home the salvage prizes was the trawler *Mammy Yokum* of Sarasota.

Capt. Marvin J. Miller told a tale of how he raised two sunken and abandoned shrimp trawlers off the Campeche coast and sailed them across the Gulf of Mexico through dangerously heavy weather to the East coast of Florida. The *Spot Pack* normally brings home about 40,000 pounds of frozen shrimp but the \$75,000 in prize money the crew expects to share will more than offset the loss in shrimp money. The *Spot Pack*, a 102-ft. ex-mine sweeper, is powered with a 400 hp. Cooper-Bessemer diesel engine and 2 Hercules 25 kw. generating sets. The deck winch which played an important part in the salvage operation is powered with a General Motors diesel.

EMD Appointments Announced



George W. Elsey



J. E. Hacker



E. A. Wondracheck

Appointment of George W. Elsey to the newly created post of manufacturing assistant to the general manager was announced by N. C. Dezendorf, vice-president of General Motors and general manager of Electro-Motive Division in LaGrange, Illinois. Other personnel changes in Electro-Motive Division announced by Mr. Dezendorf were: J. E. Hacker, assistant works manager to works manager; E. A. Wondracheck, repair plant manager to manufacturing manager, Plant No. 1 at LaGrange, Illinois. Mr. Elsey, a native of Modesto, California, joined General Motors with the Remy Electric Company, later to become Delco-Remy Division, April, 1923, as a process engineer. He served in several engineering capacities, including chief process engineer, before transferring his activities to Electro-Motive in 1936. He has served as master mechanic, plant engineer and works manager prior to his present appointment as manufacturing assistant to the general manager. Mr. Hacker, a native of Cleveland, Ohio, joined Electro-Motive as assistant works manager from Cleveland Diesel Engine Division in 1948. He received his early experience with the Winton Motor Car Company and Winton Engine Works. During World War I he left Winton to serve in the United States Army Ordnance Department Bureau of Engineering on tanks and tractor design. He is a member of the Society of Automotive Engineers and served that

society as vice president in charge of production activities and as chairman of the Cleveland section.

Mr. Wondracheck, a native of St. Louis, Missouri, joined Electro-Motive June 28, 1935 as a machinist. In November of 1935 he became a service instructor. He has worked as service mechanic, special service engineer, general foreman and superintendent of all divisions of manufacturing, prior to the present appointment.

Metal Hose Technical Data Book

Edited to satisfy both the engineers' and purchasing agents' want for information, Universal Metal Hose Company's compact, yet complete, data book

includes information on application, temperature ranges of various types of metal and wire braided hose, dimensions, couplings, assemblies, etc. Types of Universal flexible metal hose illustrated and described therein include seamless all-metal flexible pressure hose; interlocked suction, blowers and conveyor hose; square-locked conduits and flexible spout tubing; high pressure hydraulic hose; double wire-braided hose for high pressure; single wire-braided hose for medium and low pressure; and others for special applications of vibration elimination, steam, gas stove connectors, etc. Copies of the new data book may be obtained by writing to Mr. A. M. Younger, sales manager, Universal Metal Hose Company, 2133 South Kedzie Avenue, Chicago 23, Illinois.

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The letters "CP" are certain to become more important in your thoughts of filtration as times goes on. What do they mean to you?

You can give them many meanings. Consistent Performance. Constant Protection. Continuing Production. Calculated Profits. All of these are important to you. And all of them can be the result of the real meaning of "CP".

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Bulletin on Nordberg Duafuel Engines

Publication of a new three-color, 16 page bulletin on the design, construction, operation, and application of Nordberg two-cycle Duafuel engines is announced by Nordberg Manufacturing Company. The Nordberg Duafuel engines described in Bulletin 202 are built with either high or low pressure fuel injection systems to meet specific operating conditions. These engines, but in 29 in., 21½ in. and 17½ in. cylinder bore sizes, are designed to burn gas plus pilot oil, fuel oil only, or intermediate proportions of either fuel. Nordberg Duafuel engines are built for instant changeover from oil to natural gas operation, either manually or automatically.

Many design features of Nordberg Duafuel operation are discussed in this new bulletin, including descriptive data on the pilot oil injection system, hydraulically actuated gas valves, forced feed lubrication, positive action safety devices, etc. Bulletin 202 is also well illustrated with typical engine installation views and many of the operating advantages are listed. This bulletin describes the rugged construction of these Duafuel engines and sectional views and assembly pictures illustrate the pertinent features. In addition, a schematic diagram of the Nordberg low pressure gas Duafuel engines shows the starting air, fuel oil and gas systems.

Bulletin 202 is available free upon request to the Nordberg Mfg. Co., Milwaukee 1, Wisc.

Eaton Parts for Diesel Engines



**have a background of
years of cooperation with the
Diesel industry**

Eaton is proud to have served as supplier to leading Diesel engine manufacturers for many years—furnishing valves, free-valves, lash adjusters, valve seat inserts, cam followers, bolts, studs, and other precision

parts. This close cooperation with the Diesel industry has given Eaton engineers a thorough understanding of the requirements of specific engines, so essential in solving valve-train and other problems.

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PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings • Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

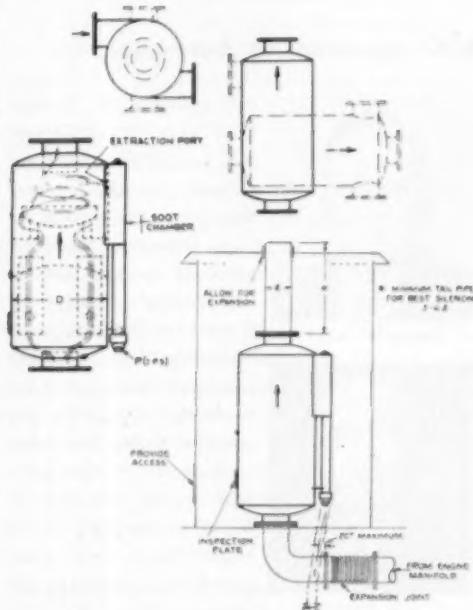
Young Radiator Promotion



Anthony D. Bogus

Anthony D. Bogus, sales engineer, has been promoted to assistant sales manager of the Industrial and Oil Field Division, according to a recent announcement made by John J. Hilt, vice president of Young Radiator Company, Racine, Wis. In addition to his new responsibilities, Mr. Bogus will continue to handle sales and engineering of oil field and heat transfer equipment. He became associated with Young Radiator Company in 1946 after serving four years in the U. S. Navy as an ordnance officer, Lt. (sr. g.). He graduated from Marquette University in 1942 with a bachelor of science degree in chemical engineering.

"Uniflo" Exhaust Mufflers



"Uniflo" exhaust mufflers and spark arrestors have been on the market for many years. Principle characteristics of the "Uniflo" design are minimum resistance to gas flow and no flat surfaces to drum or distort. The exhaust muffler is of the resonant type using no absorption media or tortuous passages. "Uniflo" spark arrestors are of the centrifugal type. Forces and velocities are so calculated that all sparks capable of causing damage are removed and with them a high percentage of micron-sized particles.

The mufflers are engineered to the requirements of each application. They are designed to specified back pressure and noise levels and these conditions determine the size of the unit. Connections are then added to suit exhaust piping size and arrangement. "Uniflo" mufflers are available in either wet or dry types. The illustrations show flexibility of arrangement, a typical installation and the working principles of spark arrestor. Full particulars and engineering service may be secured from Marine Products & Engineering Co., 150 Nassau Street, New York 38, N.Y.

Inland River Reports

By DAVID I. DAY

IN USE at the coal unloading dock of the Union Electric Company, St. Louis, is the new boat used for switching purposes and bearing the unusual name of *Totem Kole* and built by the Barbour Metal Boat Works at Lemay, Mo. She is 47 x 13 x 3½ and is powered by twin Cummins Diesels with a total of approximately 400 hp. We learned in St. Louis that Capt. William Dunham, well-known in river circles, is in charge of the new boat.

SEVERAL letters of the month from the upper Ohio contained praise for the M.V. *Lehigh* of the Union Barge Line, Pittsburgh. She is now in the trade between Pittsburgh and Cincinnati, pushing big tows and making a reputation for handling the barges smoothly in rough river. She is using twin National Superior engines and with her Kort Nozzles can be rated at around 2800 hp.

SO FAR, the *LaCrosse Socony* has pushed the biggest tow reported from the upper Mississippi since the opening of navigation. She had twelve heavy barges recently making good time. She is rated at 3200 hp., using General Motors twins. She has made many fine trips since her completion last year at the yards of St. Louis Ship.

FROM N. J. Reeves, letter mailed at New Orleans, we had a nice picture this month showing the *New Orleans* of the Mississippi Valley Barge Line working her way up past Baton Rouge. This big pusher was once called the *Herbert Hoover*. She has recently undergone repairs at the Avondale Yards, New Orleans. This towboat, 215 feet long, with General Motors twin General Motors, around 3200 hp., is in full motion one of the inspiring sights of the inland waterways.

QUITE a sensation is always created in the canal through lower Louisiana to the Texas oil fields, when the M.V. *Gene Hutchinson* appears. This fine flagship of the Hutchinson Barge Line, Inc., is regarded in the Land of the Creoles as the last word in luxury. Roy Chamberlain has charge of the *Gene's* twin General Motors engines—known as a fine chief engineer in charge of a fine engine room.

THE BIG sensation of the early spring on the Monongahela River is the new *Aliquippa* of the Jones & Laughlin coal fleet. She has Superior diesel twins, totaling 1400 hp., making her now the most powerful boat in the regular Monon pool trade. She rates high with the amateur color photography fans as she flaunts her green and yellow paint. The steamert *Wm. Larimer Jones* has been retired. Two more steamboats will go with the arrival of the new *Vulcan* and *Titan*, diesel vessels. The doomed steamers are the steamer *Titan* and the *Warren Elsey*.

THE STEAMER *E. D. Kenna* (Hillman-owned) is being dismantled. The *Lucy Jane Lucas*, GM diesels, 1000-shp is doing the steamer's work towing coal in the Cincinnati trade.

WHEN LAST on the Illinois at Peoria and Pekin, it was a pleasure to see the little "switch" boat boat, the *Don C* spotting barges for several leading barge lines. This little 190 hp. boat is the property of Capt. William Clark, best known as a Federal Barge Lines pilot before he engaged in business for himself. The engines are from Buda and are certainly smoothly working units.

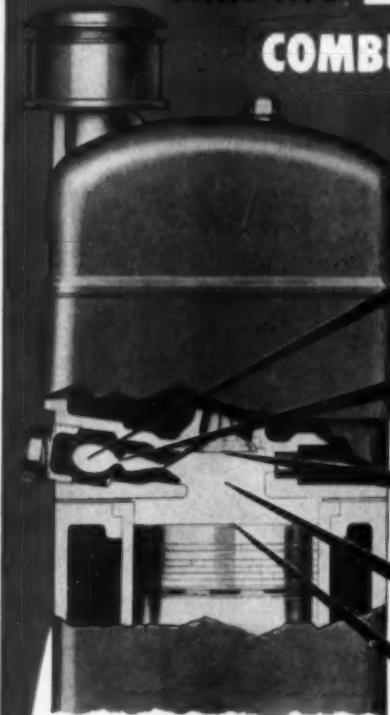
ONE OF the most popular towboats ever to work in the long oil trades is the *Linda Chotin*, pushing petroleum products from Baton Rouge, La., to Huntington, West Va. After minor repairs at the Avondale Yards, New Orleans, she is bringing up her customary profitable payloads. Built at the F. B. Walker & Sons shipyard at Pascagoula, Miss.,

the *Linda* is powered with twin National Superiors totaling around 1800 hp. Her engine room is in charge of a popular chief, H. J. Jones of Slidell, La.

The new *Casteel* of the C. J. Dick Towing Company was in trouble on the Ohio recently having lost one of her propellers. Repairs were made at the Dravo yards. This boat has Fairbanks-Morse units totaling 3600 hp. When we last saw the boat she had a tow said to be largely of benzol.

The *Coal King*, built at New Orleans by the Alexander Shipyards and now under the supervision of the Mid-Continent Barge Line, Alton, Ill., has been all winter in the oil trade on the Ohio. She is an 1800 hp. boat with General Motors twins.

Why it pays to buy a diesel with the LANOVa COMBUSTION SYSTEM



The Lanova Combustion System provides a scientifically engineered combustion chamber designed to insure better, more efficient utilization of fuel in the development of useful power. It—

- ISOLATES LIFE-SHORTENING PRESSURE BLOWS** by absorbing peak combustion pressures in the heavy-walled Lanova energy cell where they can't slam down on rings, pistons, pins and bearings.
- TIMES AND CONTROLS WORKING PRESSURES** through specially designed orifices to insure the maximum "push" at a favorable crank angle and throughout the full degree of the power stroke.
- KEEPS VALVES FREE AND CLEAN** by maintaining high combustion efficiencies and eliminating the likelihood of dirty exhaust and carbon impairing effective valve sealing.
- PROVIDES EXTRA FUEL ECONOMY** by thoroughly mixing fuel with the air needed for full combustion—thus getting more power from every drop of fuel used.
- MINIMIZES PISTON AND RING TROUBLES** by directing the blast of hot gases from the energy cell away from the piston, insuring cooler pistons, better lubrication and less ring trouble.

Many leading makes of diesels have incorporated the Lanova Combustion chamber design. You'll always recognize them by looking for the characteristic Lanova energy cell design.

Write for the Lanova Handbook
It has full details on why combustion is so important in efficient Diesel operation and how the Lanova Combustion System insures better combustion.

LANOVA CORPORATION
38-17 30th Street, Long Island City 1, N.Y.

One of America's foremost names in diesel research and development

Acquires Supercharger Business

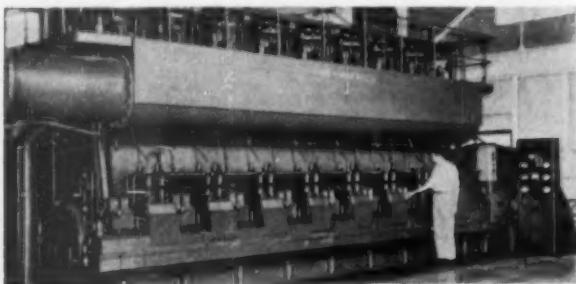
Mr. George Heintzemann, president of Dexter Folder Company, Pearl River, New York, announced that his company has acquired the supercharger business formerly owned and operated by the Pesco Division of Borg-Warner Corporation.

The new activity will be known as the Miehle-Dexter Supercharger Division of Dexter Folder Company and will be located in the plant of The Christensen Machine Company, a wholly owned subsidiary of Dexter Folding Company. The Miehle Printing Press & Manufacturing Company of Chicago has a substantial interest in the Dexter Folding Company, and the engineering and other

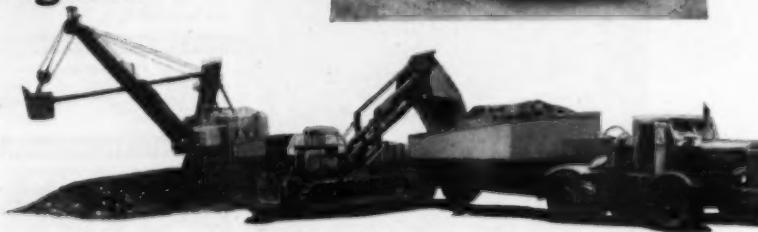
resources of Miehle, Dexter and Christensen will be available to the new division.

Mr. Heintzemann also announced that Mr. Hans Bohuslav has been appointed general manager of the division with headquarters at 100 Fourth Street, Racine, Wisconsin. Mr. Bohuslav is well known in the diesel and gas engine fields. He was previously with R. G. Letourneau, Inc., Longview, Texas and Peoria, Illinois. Prior connections were with Sterling Engine Company, Buffalo, New York as vice president in charge of engineering and with Enterprise Engine Company, San Francisco, California as chief engineer and vice president.

The new division will engineer, manufacture and



New D-X Extrinol formula means more protection for Diesel engines



Because D-X Diesel Motor Oils now are stepped up with a new formula of Extrinol they can help diesels operate even more efficiently and with greater protection against wear in every kind of service — mobile, stationary, or marine.

This new Extrinol is a group of improved chemical additives which give D-X greater resistance to contamination, more toughness for operation under heavy loads, and increased cleansing power.



MID-CONTINENT PETROLEUM CORPORATION
TULSA, OKLAHOMA
Waterloo, Iowa
Terre Haute, Indiana

Omaha, Nebraska
Chicago, Illinois
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D-X Diesel Motor Oils

sell superchargers of all types to engine builders. A standard line of positive displacement type of blowers is now in production, many of which have been standard equipment with several major engine builders for a number of years. In addition special designs to suit any diesel or gas engine can be furnished and competent engineering assistance in applying superchargers to engines will be available.

Large Diesel for Generating Plant



The largest Hamilton diesel engine to be in stationary power plant service east of the Mississippi river started recently for Decatur, Ind., on these five freight cars at the Hamilton Works of Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio.

These cars carry most but not all of the parts for a 12-cylinder, 5370-hp. diesel engine which will drive a 3810-kw. generator in a new division of Decatur's municipal power plant. This power unit is to be housed in a new building of ultramodern design which is nearing completion. The new engine, a 2-cycle diesel with 21½-inch bore and 27½-inch stroke operating at 240 rpm., will provide a substantial portion of the city's electric power and light.

New Diesel Engine Bulletin

Bulletin #5204 just released by The National Supply Co. Engine Division, Springfield, Ohio, describes the Lister Models FR1, FR2, and FR3, 4-cycle, stationary diesel engines. The 4-page folder gives engine dimensions, weights and technical data on these 1500 and 1800 rpm., 8 bhp. to 27 bhp., one to three cylinder units. The FR engines have chrome-hardened cylinder liners, individual fuel-injection pumps for each cylinder, and oversize crankshafts. High and low compression ratios, for easy starting and normal running, respectively, are selected by spring-loaded levers.

Free Tool Guide Available

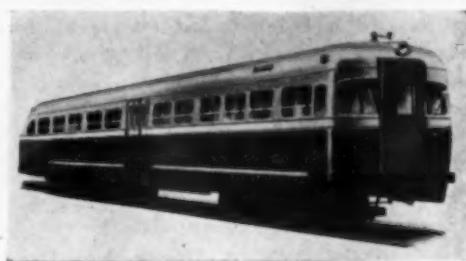
A new diesel service tool guide containing complete information on all essential tools required to perform factory recommended service on GM Series 71 and Series 6-110 diesels is available from Kent-Moore Organization. It is a comprehensive 48-page book, classified and illustrated. It lists more than 300 special diesel tools for the performance of specific repair and maintenance operations.

The guide is obtainable at no cost by writing DIESEL PROGRESS, File 106, Box 8458, Cole Station, Los Angeles 46, California.

Coming - Mack Rail Bus

IN 1950 Mr. F. C. Dumaine, Sr., late president of the New York, New Haven & Hartford Railroad, first presented his idea for a modern diesel rail bus to the Mack Company. The vehicle he had in mind would have to be capable of reducing operating costs on branch and feeder lines. Mack engineers, cooperating with Mr. Dumaine and his staff, translated his idea into reality in October, 1951, when the pilot model FCD rail bus was placed in operation. During the many months since that time, the first Mack FCD has been rigidly tested on various branch and feeder lines of the New York, New Haven & Hartford systems. The merits of suggested additional features were thoroughly evaluated. Certain refinements were incorporated into the car while it was still undergoing these service tests. This period of experience proved conclusively the remarkable economy and practical value of the Mack rail bus for the particular purpose it had been designed, and resulted in an order for nine new Model FCD rail buses placed with Mack by the New York, New Haven & Hartford. These new vehicles will incorporate all of the design improvements and features developed as a result of the pilot model operation.

The basic unit is a Mack bus body and frame mounted on two, 4-wheel rail trucks. Two sets of controls, one at each end, permit operation of the Rail Bus in either direction. Hand lever at driver's right controls speed and a foot pedal actuates the air brakes. The instrument panels have an electric



speedometer with built-in odometer, air pressure gauge, and the standard indicating lamp cluster showing "stop," "not generating," "emergency," "door" and "water." Sander valve control is on driver's left. A hand operated air horn and air actuated bell are included as standard equipment.

Two entrance doors located on either side at the center, are four-leafed, inward-opening with non-shatterable glass. Wide doors allow passengers to enter and leave at the same time, giving faster passenger interchange for shorter station stops. Doors can be operated selectively and are interlocked with brakes and accelerator to prevent bus from moving while doors are open.

Designed specifically for branch and feeder line service with its short hauls, the Rail Bus single or two car operation reaches speeds of 18 miles per hour in 10 seconds, 26 mph. in 20 seconds, 32 mph. in 30 seconds and attains maximum speed of 54 mph. in three minutes for single car and 61 mph. in three minutes for two car operation. This rapid

acceleration, coupled with its top speed, make the Mack Rail Bus ideal for short line service involving frequent stops with short distance between stops.

A Mack supercharged diesel engine drives a 300-volt generator which generates current for the four variable voltage DC traction motors. There is a 55 hp. motor for each axle of the trucks. Therefore all axles are "drivers." The generator is direct-connected to the engine and has a built-in blower for self-ventilation. One end of the generator armature runs on an anti-friction bearing while the other end is connected to the engine flywheel by a laminated steel disc flexible coupling.

An auxiliary generator charges the battery and provides power for the fluorescent lighting system. Equipped with external current and voltage regulation, the generator is belt driven from the end of the propulsion generator. The rectifier for battery charging is mounted in the engine air induction system for positive cooling, long life and minimum maintenance.

Two 12-volt, 25-plate, 200-ampere-hour batteries mounted on sliding trays in separate compartments provide power for the 24-volt starting motor. Driving through a Dyer type drive, the starting motor is energized from a D-R series-parallel switch to obtain 24 volts during starting. Maintenance and repair costs are cut by the generator interlock relay in the starting circuit which prevents starter engagement when the engine is running.

inside tip. ...

only **HONAN-CRANE**
DIESEL OIL PURIFIERS give you so many vital
ENGINEERING FEATURES

The Honan-Crane "Multi-Cartridge" Purifier is engineered, inside and out, to provide the high-flow, thorough oil purification essential for diesels. Removes all types of harmful contamination . . . substantially reduces engine wear and maintenance costs . . . quickly pays for itself in oil savings alone!

Here are a few of the time-tested features that make Honan-Crane preferred for safety and savings wherever diesels are used

INTERCHANGEABLE CARTRIDGES FOR HONAN-CRANE PURIFIER

TYPE "MC" — Cotton bag packed with Granite (fuller's earth). Removes solids and products of oxidation . . . acids, gums, etc. Provides refinery-type purification.

TYPE "MF" — Perforated metal basket packed with Palconite (cellulose fiber). Recommended for additive oils for complete removal of dirt, scale and other solids.

TYPE "S" — Contains Palconite (cellulose fiber). Performs same as Type "MF." Fiber center-tube permits complete disposal of spent cartridge by burning.

TYPE "E" — Similar to Type "S" except that filtering material is cotton waste and excelsior. Type "E" is recommended when water is encountered in the oil.

WRITE US ABOUT YOUR
OIL PURIFICATION
PROBLEM

Honan-Crane Fuel and Lube Oil Purifiers are available for any size or make of Diesel Engine. For detailed information, write Honan-Crane giving make, model and H.P. of your diesel. Describe any unusual aspects of your oil purification problem.

1 Cartridges are readily interchangeable to provide type and degree of purification required.

2 Clean oil is drawn from top of purifier. Maximum efficiency of each cartridge is utilized.

3 Cartridge design prevents channeling or bypassing. Multiple units provide high flow rate.

4 Electric heater bands maintain correct oil temperature. Steam, hot water heating available.

5 Oil-and-gas-tight seals and gaskets prevent seepage. Dirty oil cannot contaminate clean oil.

6 Double-decked cartridges save floor space, permit clean design, greater operating efficiency.

7 Positive locks and pressure springs keep cartridges securely in place, prevent bypassing.

8 Purifier is fully equipped with automatic controls and safety features. Requires no attention.

HONAN-CRANE CORPORATION
203 Indianapolis Avenue, Lebanon, Indiana
A Subsidiary of

HOUDAILLE-HERSHEY CORP.

WORLD LEADING
OIL FILTER MANUFACTURER

Alco-GE Appointments



R. A. Weston



C. F. Venrick

The appointment of Charles F. Venrick as manager, Alco-GE locomotive sales and field service and Ralston A. Weston as manager of stationary and

marine diesel engine sales was announced by John P. DeLaney, general manager of transportation services of the American Locomotive Company. Both men will report to Mr. DeLaney and will be located at Schenectady, N. Y. Mr. DeLaney also announced the appointment of John W. Linford to his immediate staff. Mr. Linford was formerly manager of stationary and marine diesel engine sales for the company.

Program of the 25th Annual Conference and Exhibit of Oil & Gas Power Div.

A. S. M. E., Hotel Schroeder, Milwaukee

Monday May 25

9:00 A.M. Registration

10:30 A.M. Paper on Waste Heat Recovery by Robert C. Coblenz.

12:00 Noon Social Hour.

12:30 P.M. Welcome Luncheon. Chairman—A. W. Colwell, A. O. Smith Corp. Speaker—Harry C. Brockel, Milwaukee Municipal Port Director

2:00 P.M. Paper on Valves for High Output Engines by Allen & Newton of Thompson Products Co.

8:00 P.M. Meeting of General Technical Committee, open to all.

Tuesday, May 26

8:00 A.M. D.E.M.A. Breakfast for Engineering Professors.

9:00 A.M. Registration. O.G.P. Special Lecture, "Metallurgy of Cast Ferrous Metals," by T. Egan, The Cooper-Bessemer Corp.

2:00 P.M. Panel Discussion, "Diesel Engine Power Plant Design." Chairman—E. C. Schum, Baldwin-Lima-Hamilton Corp.; V-Chm. Stuart Nixon, Sealed Power Corp. Panel members: Lyle B. Brady, Asst. Supt., Power Plant, Rochelle, Ill.; John W. Cramer, Fulton & Cramer, Consulting Engineers; Robert Cramer, Jr., Asst. Chf. Engr., Nordberg Mfg. Co.; Walter C. Fischer, Mgr. Eng., Fairbanks, Morse Co., S. K. Fosholt, Stanley Engineering Co., Muscatine, Iowa.

6:00 P.M. Exhibitors' Social Hour.

6:30 P.M. Annual Banquet. Chm. Karl Stinson, Univ. of Ohio and Chm. Executive Com. O.G.P. Toastmaster, A. W. McKinney, National Supply Co. Speaker, Frederick S. Blackall, Jr., Pres. A. S. M. E. Subject: "Western Europe Through an Engineer's Eyes."

Wednesday, May 27

7:45 A.M. D.E.M.A. Breakfast for Chief Engineers.

9:00 A.M. Registration

9:30 A.M. Paper on "Investigation of Flame Temperatures in a Spark-Ignition Engine," by Messrs. Potter and Dillaway.

10:30 A.M. Paper on "Photographic Study of Events in a 14 in. Two-Cycle Gas Engine Cylinder," by Messrs. R. L. Boyer, D. R. Craig and C. D. Miller.

12:00 Noon Exhibitors' Social Hour.

2:00 P.M. Paper on "Two and Four Cycle Test Results of Medium Speed Engines on Heavy Fuels" by Messrs. Russell Pyles, Donald Cryer and J. M. A. Van der Horst.

3:30 P.M. Paper on "The Production and Utilization of Residual Fuel Oil," by Messrs. R. E. Albright, C. E. Habermann, N. F. Hergreuter and C. W. Hoffman.

Thursday, May 28

9:30 A.M. Paper on "Crankwebs, Including ARC-WEBC Design," by S. W. Newell.

2:00 P.M. Inspection Trip, Nordberg Mfg. Co.

Friday, May 29

8:30 A.M. Inspection Trip, via Bus, to Fairbanks Morse Co., Beloit, Wis.

A fine program has been planned for the women. In addition to the Welcome Luncheon, Banquet and Social Hours, there will be special daily activities including Teas, Cards, also Sightseeing and Plant Tours. Something doing every minute but everything optional.

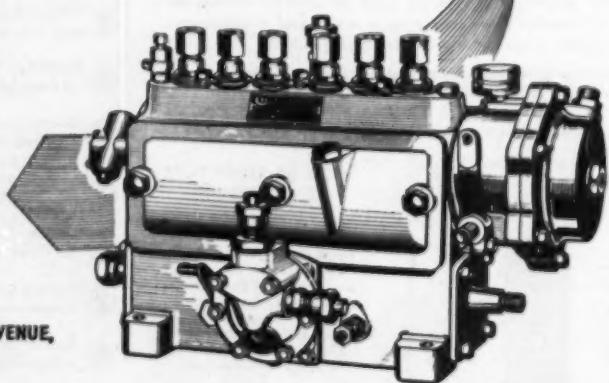
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This converted patrol vessel is an outstanding tug. It is powered with Model 06 UNION Diesel engine, 6 cylinders, 11" bore x 15" stroke, naturally aspirated, which continuously develops 300 horsepower at 350 revolutions per minute.

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**Efficient Rotary Geared
PUMPS**



Nos. 53 & 55
with Helical Gears and
Antifriction Bearings

for
DIESELS

500 Series
with Precision Gears
and Needle Bearings

It's a smooth flow at high speeds for your diesel lubricating systems when you equip them with these Brown & Sharpe Rotary Geared Pumps. Mechanical seals eliminate leakage problems... no glands to adjust or wear out. Long trouble-free performance has been proved in thousands of diesel installations.

Nos. 53 & 55 are available for pressures up to 200 psi. with capacities from 4 to 34.1 gpm. The 500 Series Pumps are available in six sizes for pressures up to 500 psi. and with capacities from 5.1 to 37.6 gpm. Write for complete Pump Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

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ORIGINATOR OF MICRONIC FILTRATION

the **Finest**

**Way to Make
Liquids Come Clean**



Nine times out of ten **Bendix-Skinner** filters will supply the "finest" answer to your problem. No magic—just the simple fact that **Bendix-Skinner** has developed entirely new and exclusive filtering techniques in twenty years of tackling the tough jobs. We'll welcome an opportunity to prove it. An inquiry costs you nothing and may save you much.

Over 350 Models providing filtration
from $\frac{1}{2}$ micron ($0.00019"$) upwards
at flow rates from 1 to 5000 g.p.m.



"I could see the corpsman kneeling over me. The blood plasma was running down through a tube into my arm and he said everything was going to be O.K. I was walking across an enemy mine field in Seoul when one exploded and a piece of shrapnel caught me in the leg.

"Got enough of that stuff?" I asked him, pointing to the blood. "I guess we never have enough," he said, "but you can thank *somebody* for this pint."

"How do you thank 'somebody' for blood? For saving your life? When I got back home, I discovered the answer at my local blood donor center. There's only one way to say thanks—by giving some of your own blood."



"How do you thank 'somebody' for Blood?"

Yes, all kinds of people give blood—for all kinds of reasons. But whatever your reason for giving blood, this you can be sure of: Whether your blood

goes to a combat area, a local hospital, or for Civil Defense needs—this priceless, painless gift will some day save an American life!

Business Executives! ✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- Have you given your employees time off to make blood donations?
- Do you have a Blood Donor Honor Roll in your company?

- Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?
- Have you arranged to have a Bloodmobile make regular visits?
- Has your management endorsed the local Blood Donor Program?
- Have you informed employees of your company's plan of co-operation?

- Was this information given through Plant Bulletin or House Magazine?

- Has your company given any recognition to donors?
- Have you conducted a Donor Pledge Campaign in your company?

Remember, as long as a single pint of blood may mean the difference between life and death for any American . . . the need for blood is *urgent*!



Give Blood Now—Call Your Red Cross Today!

National Blood Program

Organizational Changes



Donald F. Rogers



H. W. Barth

Thomas E. Hughes, general manager of the Cleveland Diesel Engine Division of General Motors, announced several organizational changes. H. W. Barth, a native of Cincinnati, Ohio and most recently chief mechanical engineer at General Motors Electro-Motive Division, La Grange, Illinois, becomes chief engineer at Cleveland Diesel. This appointment will consolidate under one head, for the first time in several years, all the product engineering activities in the Division. Mr. Barth, a graduate of Dennison University, class of 1934, joined the Winton Engine and Manufacturing Company, predecessor of Cleveland Diesel, in the fall of 1934. In 1936 he was transferred to Central Diesel Section at General Motors Research in Detroit, where he worked on the development of the GM locomotive engine. In November, 1938 he was transferred to La Grange, Illinois where he held various positions in the Engineering Department until this most recent appointment in Cleveland.

In line with the revamping of the Engineering Department, Harry Heinzen, who has been chief electrical engineer, becomes assistant chief engineer—Electrical. Mr. Heinzen, a native of South Dakota and a graduate of South Dakota State in electrical engineering in 1928, joined Cleveland Diesel in 1935 and has held various positions in the Electrical Engineering Department since that time. Eric Brater, a graduate of Massachusetts Institute of Technology, class of 1924, came with the Winton Engine and Manufacturing Company in 1933, as technical assistant in the Mechanical Engineering Department. He will be assistant chief engineer—Mechanical. W. E. Brill, a native of Cleveland and graduate of Case Institute of Technology, was first employed at Winton in 1925. Mr. Brill will continue as Assistant Chief Engineer—Design and Development.

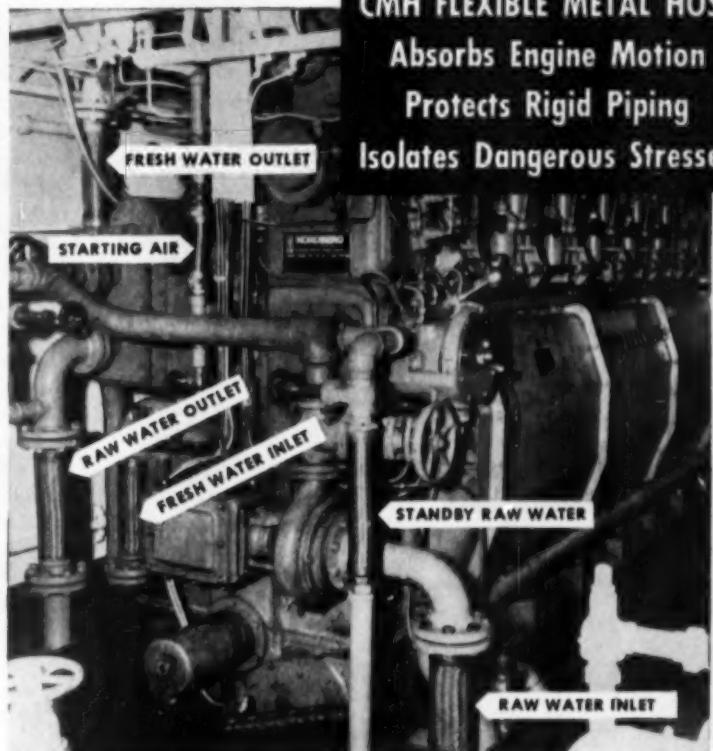
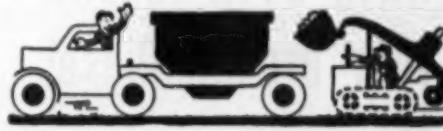
Horace Trainer, a graduate of the United States Naval Academy in 1925, who has been engineering field representative for Cleveland Diesel at New London, Conn., since 1934, is transferred to Cleveland on the electrical engineering staff. In appointments affecting other departments, Donald F. Rogers has been named service parts manager, filling a vacancy created by the recent death of Ray Pollock. Mr. Rogers was born in Conneaut, Ohio. His first employment at Winton was as a factory worker in 1933. He was transferred to the Traffic Department in 1936 and in 1946 was named traffic manager, which position he has held until his appointment as service parts manager. The activities formerly under the direction of Mr. Rogers will function as a part of the Production Control Department, under the supervision of Robert F. Betz.

All of the foregoing appointments and changes announced by Mr. Hughes, were made at the direction of J. W. Brophy, works manager, to whom these departments report. Mr. Hughes also announced the appointment of K. O. Keel, formerly chief mechanical engineer as government contract sales manager. For the past nine years, Mr. Keel has devoted a considerable part of his time to this phase of Cleveland Diesel's operation. He will report directly to the general manager.

The Fluor Corporation, 2500 So. Atlantic Blvd., Los Angeles 22, California. Known as Fin-Fan heat exchangers, the units described are of the forced draft type and are designed to cool liquids or gases at pressures up to 5,000 psi. and temperatures as high as 1,500 degrees F. These air-cooled units are being installed to replace or augment water-cooled heat exchangers in many plants faced with the necessity of dissipating great heat loads from everyday processes. Copies will be mailed free on request.

Air-Cooled Heat Exchangers

A 12-page, illustrated bulletin on air-cooled heat exchangers for a wide variety of industrial cooling and condensing applications has been issued by



Vital piping connected to the Nordberg marine diesel shown above, is protected with CMH Flexible Metal Hose. The stresses of vibration, expansion and contraction, and misalignment are effectively absorbed by these flexible connections. In existing installations or new ones, it will pay you to eliminate these common causes of piping failure with CMH Flexible Metal Hose. Write for Bulletin 124.

CHICAGO METAL HOSE Division

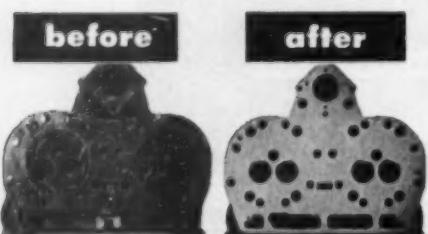
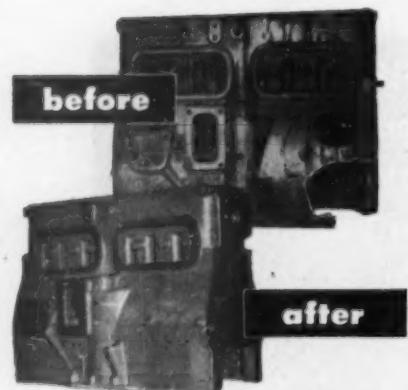
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Save the cost of new castings. Get your equipment back into service quickly with less expense. Send your broken Diesel heads, blocks and castings to Guth for **guaranteed renewal** by the Guth Fusion Process. Backed by 25 years of successful use, the Guth Fusion Process is a scientifically correct, specialized system of completely reconstructing damaged or worn castings . . . restoring them to new or better than new condition, conforming with the latest factory specifications. Every Guth renewal job is **completely guaranteed**. Ask any user—or write today for illustrated catalog. Dealerships open in some areas . . . full information on request.



Figure 1. A Warner Lewis filtration installation on a line for a Southern pipeline company.

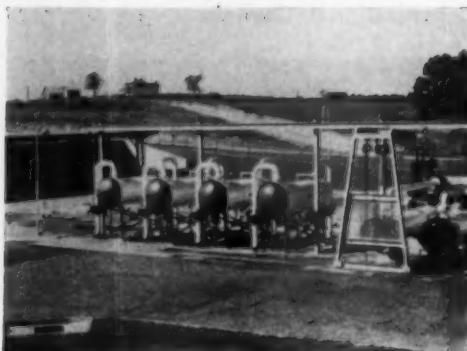


Figure 2. Filtration equipment used to process diesel fuel before introducing it into the line for transport.

CLEANING FUEL

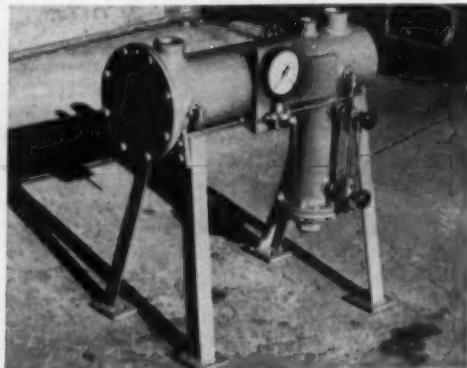
Successful Decontamination of Fuel Adds to Engine Efficiency and Life

One of the major bugaboos in the operation of internal combustion engines is the constant problem of fuel contamination. Besides lowering the operational efficiency of the engine, dirt and water in the fuel imposes a serious maintenance problem. Damage to the engine by these factors can shorten its life to a considerable degree. The development and engineering of equipment to forestall any damage caused by contamination has added many "working days" to the life of present diesel equipment. Such filtration equipment has kept pace with the advanced design of modern engines.

The matter of clean fuel is not solely the problem of the diesel operator. When water, scale and muck occur in refinery or pipeline products the result is trouble for the producer. They reduce capacity, increase processing costs, and cause excessive wear and tear on valves and sticking or wear of meters and pumps. The removal of any contamination thus starts long before the fuel is received by the engine operator.

Figure 1 shows an installation in one Southern oil company's pipeline. This bank of Warner Lewis separators and filters processes fuel to eliminate water, scale and corrosion prior to introducing it into their pipeline for transportation. Figure 2 is a similar pipeline installation through which diesel

Figure 3. A 25-gallon a minute Warner Lewis E-25 separator applicable at a tank truck loading point along the highway.



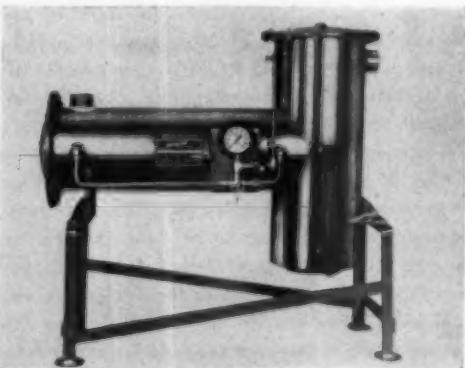
fuel is processed prior to introduction into the line for transport. This type of processing is particularly necessary in the case of diesel fuel since it can collect water in many different ways and places between the refinery and the final consumer. It is essential that it be processed and the water and solid particles removed as often as possible to keep it clean throughout its journeys and transfers.

Figure 3 is a Warner Lewis separator. This is a 25-gallon a minute water separator applicable at the truck loading point along the highway for final stage water removal prior to introduction into truck tanks. Figure 4 shows an Excel-So separator Model FE-80 by the same manufacturer. This is a combination separator and micronic filter which can also be used on diesel fuel at truck loading or fueling points as well as processing it in transit from place to place.

Clean fuel in every type of engine, whether it be for locomotive power, stationary use, highway and off-highway equipment and marine applications, is an important factor in their life and efficiency.

Clean fuel cuts down on the corrosion of fuel injectors and cylinder walls, means fewer maintenance problems and contributes to a minimum of down time.

Figure 4. A combination water separator and micronic filter manufactured by Warner Lewis. It is an Excel-So Model FE-80.



DIESEL PROGRESS

Gulf Coast Diesel News

By MICHAEL T. PATE

STEWART & Stevenson Services, Inc., of Houston, have installed two General Motors Model 6071A marine propulsion diesels on the ferry *Nellie B.*, to operate between Corpus Christi and Port Aransas, Texas. The engines are mounted in line, with a propeller at each end of the ship, so that one engine operates "in reverse" whichever way the ferry is operating, and thus the need for turning the vessel at each end of the run is eliminated.

DUVAL Sulphur & Potash Company, Carlsbad, New Mexico, has bought two model 180 DLC diesels from Waukesha Sales & Service, Houston, to be installed as motive power in jeeps being rebuilt for hauling personnel and materials in the underground workings of the company's potash mines. The engines develop 22 hp. at 1200 rpm.

HORTON & Horton, building materials contractors of Houston, have bought from Mustang Tractor & Equipment Company, Houston, two Caterpillar diesels, model D375, each developing 270 hp. at 400 rpm. The diesels will power the company's new 60x20x6½-foot tug *Sallie Sewall* through 3:1 reduction gears to 58-inch wheels. The twin screw tug is being built by Platzer Boat Works, Houston.

KERR-McGEE Oil Company, Tulsa, Oklahoma, is replacing 500-hp. gas engines on its offshore platform destroyed by fire with three General Motors

Model 24103 diesel power units, secured through Stewart & Stevenson Services, Inc., of Houston. The three engines are compounded to drive a National 125 drilling rig.

EXPLORATION Equipment Company, 3806 W. Alabama, Houston, has secured two Buda 30 hp. diesels Model BD 153, through Buda Engine & Equipment Company, Houston, to be used as drive units on two geophysical drilling units.

HALLIBURTON Oil Well Cementing Company, Duncan, Oklahoma, has purchased through Stewart & Stevenson Services, Inc., of Houston, five additional General Motors model 4031C diesels to power truck-mounted cementing pumpc.

JOE SMITH Implement Company, Las Cruces, New Mexico, has secured from Waukesha Sales & Service, Houston, a Waukesha diesel rated 150 hp. at 1400 rpm., to power an irrigation water well in the Las Cruces area.

BEL-TOE Foundation Company, 4651 Telephone Road, Houston, has bought from Mustang Tractor & Equipment Company, Houston, one Caterpillar diesel, model D315, to repower a Link-Belt speeder for use in the company's foundation work.



ASCO
HEADQUARTERS
FOR
SOLENOID VALVES

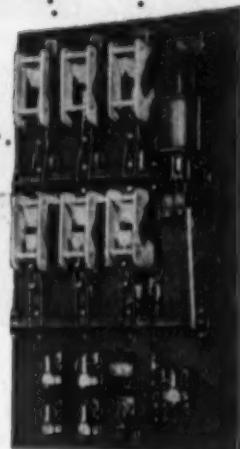
SOLENOID VALVES FOR ALL PURPOSES



Many new developments for the Diesel industry, in particular valves for the control of fuel, lube oil, and cooling water. Also Automatic Air Starting Valves for interlocking with one or more normal and emergency electric power sources. To thousands of satisfied users throughout industry, 'ASCO' and 'Solenoid Valves' are synonymous. Write for literature.

BULLETIN 8242
Solenoid Valve
for 1/8 and 1/4 inch
Pipe Sizes

HEADQUARTERS FOR
**AUTOMATIC
TRANSFER
SWITCHES**



Specialized electromagnetic controls are our business and Automatic Transfer Switches are vital specialized controls. All we want to do is to make the best, the most durable, and the most reliable specialized controls humanly possible.

With these ideals, is it any wonder that outstanding engineers prefer and specify ASCO Automatic Transfer Switches?

Asco Automatic Transfer Switches Feature:

- Complete range of sizes from 5 to 1000 amperes for all types of loads.
- Positive operation — double throw construction provides inherent interlocking.
- Capacity to withstand the tremendous inrush of tungsten lamp load, the severe arcing from inductive loads, and the heating effects of short-time fault currents.
- Adequate designs and arrangements for microwave, television and radio, hospital, subway, marine and other types of electrical installations.

Free! New Informative Bulletin!

Reserve your free copy of the new booklet "Automatic Transfer Switches" now ready for publication. The booklet discusses such important features as close differential voltage supervision, arrangements to ignore momentary outages, stand-by electric plant installations, accessory devices, and other factual information you'll want for reference.

ASCO
Electro-
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CONTROLS

We also manufacture a complete line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases.

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IS BETTER**
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It takes a truly outstanding product to receive over 85,000,000 endorsements. Yet, that's the number of Bendix Drives that have been installed. No other starter drive approaches this record of outstanding performance. That is why, whatever your type of diesel or whatever its purpose, it will pay you to specify Bendix* Starter Drive for the most economical installation and dependable performance.

*REG. U.S. PAT. OFF.

ECLIPSE MACHINE DIVISION of
ELMIRA, NEW YORK
Bendix AVIATION CORPORATION
Export Sales: Bendix International Division, 72 Fifth Ave., New York 11, N.Y.

Bay Area Diesel News

By BRUCE WADMAN

SAN FRANCISCO, April 15: The new Emporium store in Walnut Creek has ordered an automatic stand-by 55 kw. generator set from King-Knight Co. The generator will be driven by a 90 hp. Buda diesel.

• • •

AN open house was conducted by the Murray, Utah municipal power plant on March 14-15. In July, 1952, a Fairbanks-Morse 3500 hp. diesel was installed in the plant, increasing the generating capacity fifty percent. The engine has a generating capacity of 2200 kw. This plant is unique because of its efficient and progressive management and its record of low fuel costs per kw. hr. This is the fifth diesel that has been installed in the Murray plant.

• • •

TODD Shipyard in Seattle is currently constructing two 100 ton derrick barges. Each derrick crane will be powered by two diesel generator sets. Each set will be made up of a 225 hp. Union Model GA-6 diesel driving an Ideal generator. The engines are rated at 600 rpm.

• • •

A MEETING of the Western Regional Distributors of GM Detroit Diesels was held on March 4 at the St. Francis Hotel in San Francisco. Mr. E. F. Bentley, the new Sales Manager of Detroit Diesel Div. of GM, conducted the meeting.

• • •

FOR replacing an old diesel, a 135 hp. Murphy Model 20 diesel engine has been installed in a Northwest Model 80-D crane owned by the Winston Lumber Co. of Jackson, Calif.

• • •

A NEW series D660-47 GM diesel truck has recently been introduced in the Bay Area. The truck, which is driven by a 4-71 GM 150 hp. diesel, is comparatively light, with a gross weight of 28,250 lb. As a tractor combination, it weighs 60,000 lb. gross, and as a tractor alone, it weighs 9,930 lb. This truck still has all the power and flexibility of the 4-71 diesel drive, but in addition has a lighter chassis for larger pay-loads.

• • •

FOR repowering a locomotive used in hauling logs for the Mutual Plywood Corp. of Arcadia, Calif., a Murphy Model ME-6 diesel, supplied by Oswald Machine Works, has been installed, replacing steam power. The 135 hp. diesel drives the locomotive through a Twin Disc Torque Converter unit.

• • •

FOR Henry Doelger's Westlake project, Buran Equipment Co. has supplied three new Allis-Chalmers TS-300 motor scrapers. These are the first of this new model motor scraper to be sold in the Bay Area. Power for each scraper is supplied by a Buda 280 hp. diesel and their capacity is 14 cu. yd. struck and 18 cu. yd. heaped.

• • •

TWO new 4-51 GM 87 hp. diesels are to be installed in a 40 ft. pleasure cruiser owned by Mr. D. G. Roberts. The engines, which have been supplied by West Coast Engine and Equipment Co., are equipped with 2:1 reduction gears. This will be the first installation in the Bay Area of this new GM marine diesel.

THE new fireboat *City of New York*, rated to be the most powerful fireboat ever designed, will be powered by Enterprise diesels. The fireboat, which will measure 129 ft. in length, will be driven through twin screws that are raised in twin tunnel stems to permit navigation in shallow water. This, however, will not hamper the fireboat's maneuverability in open water. Two 1000 hp. Model DMG-38 Enterprise diesels rated at 425 rpm. will power the vessel, and two additional 1000 hp. turbocharged Model DSG-316 Enterprise stationary diesels will supply pumping power at full pressure for six monitors and sixteen hose connections. There will be a 53 ft. hose tower located ahead of the funnel—a unique feature in fireboat design.

• • •
HOVER EQUIPMENT CO. in Monterey has recently installed a 3071-A GM 83 hp. diesel with a 3:1 reduction gear in the *Ann Marie*, a 36 ft. commercial fishing boat owned by Oscar Vienola.

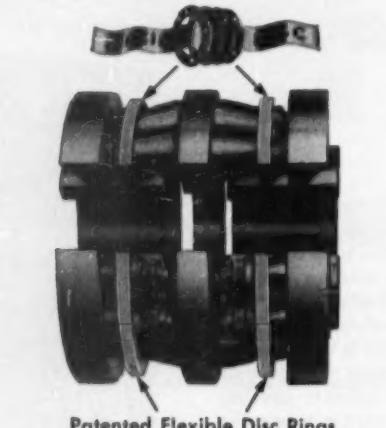
• • •
THE Albina Shipyard of Seattle recently started construction on a new 175 ft. cargo carrier for Bay and River Navigation Co. of San Francisco. This vessel will operate in San Francisco Bay for the purpose of transporting sugar from the C&H refinery in Crockett to the Bay Area for distribution. Two Model DMM-362 turbocharged Enterprise diesels, developing 400 hp. each at 800 rpm., will drive this twin-screw cargo carrier through Pacific Western reduction gears. The engines are built in true right and left hand so that the controls will be in the center for easier access.



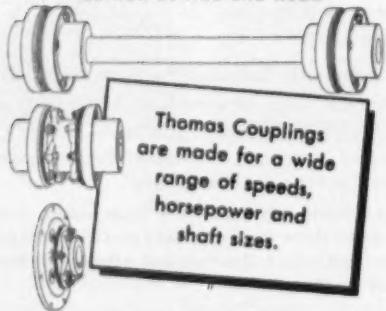
A new sales and service office at 870 Harrison Street, San Francisco, California, was opened last month by the Cleveland Diesel Engine Division of General Motors. The added floor space in this building will provide more facilities for the stocking of service parts. According to Thomas E. Hughes, general manager of the Cleveland Diesel Engine Division of General Motors, "This expansion was necessary to render greater service to ship operators on the West Coast." Mr. Hughes added that, "with the greater acceptance of GM Diesel engines since World War II, we are looking forward to a considerable increase in the use of these engines in Washington, Oregon and California. We have established offices and representatives in Seattle, Washington; Portland, Oregon; and San Diego, California. However, the West Coast headquarters will be at San Francisco." Charles C. Cheevers will continue in charge of West Coast sales and service. Mr. Cheevers has represented Cleveland Diesel on the West Coast since 1942.

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DISTINCTIVE ADVANTAGES	
FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
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NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.



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NO MAINTENANCE PROBLEMS

ALL PARTS ARE SOLIDLY BOLTED TOGETHER

Write for our new Engineering Catalog No. 51

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

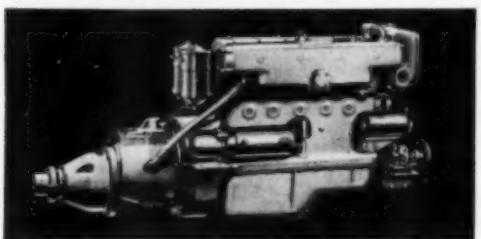
New Valve Refacer



Many railroad maintenance shops will find use for a new valve refacer now on the market. Made by The Black & Decker Mfg. Co., Towson, Maryland, the deluxe Super-Service Valve Refacer incorporates new features designed to "keep 'em rolling" more efficiently. Among them are the following: (1) A complete, integral end grinding attachment for quick, accurate and efficient grinding of valve stems, tappets and rocker arms. It features a new quick-clamp that locks a stem or tappet in place in seconds. The attachment is standard equipment on the new refacer. (2) A new coolant system, featuring wet grinding at both wheels, easy one-valve control and an improved coolant reservoir. (3) More flexible capacity: valve heads up to 4 in.; valve stems up to 11/16 in.; valve angles 0° to 90°; traverse grinds at all angles; built for the years ahead.

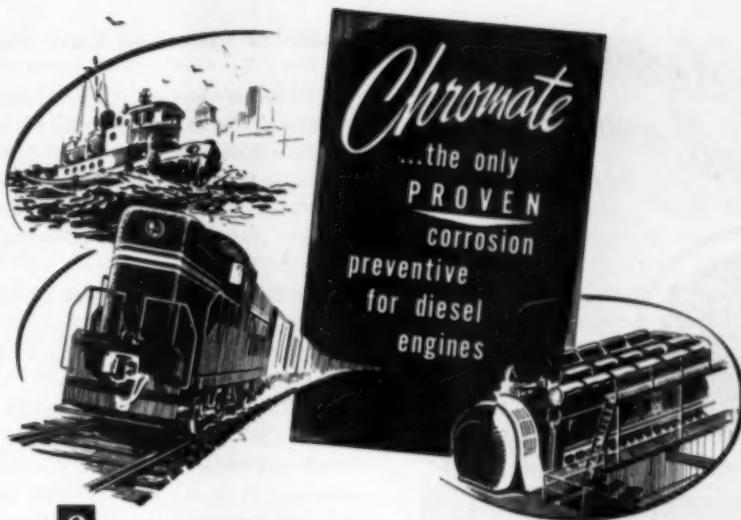
Other outstanding features of the new B&D refacer include abundant power from two independent B&D universal motors; smooth-grinding hypoid gears; quick-acting clamp on accurate valve stem collet; super-speed feed screws; simplified controls and four-point bearing mountings. Black & Decker also manufacture a No. 6 Universal Valve and Tool Grinder for refacing larger diesel valves with head diameters up to 5 1/4 in. and valve stems ranging from 1/4 in. to 1 1/4 in. in diameter.

New Graymarine Diesel



Illustrated is Gray's new lightweight diesel, a 6-cylinder model with continuous duty rating of 100 hp. It has a weight of only 1525 pounds complete with reduction gear. The engine is recommended as a replacement for gasoline engines in cruiser installations where weight is important. The engine is of the 4-cycle, high speed type with overhead valves.

The use of aluminum housings and manifold is made possible by fresh water cooling system. It is available in both rotations with choice of Snow-Nabstedt or Paragon transmission, both hydraulically operated. A cutaway model of this engine was exhibited at the New York and San Francisco Motor Boat Shows.



CHROMATES are the only tried and true answer to controlling cylinder-liner corrosion in diesel engines. Use of chromium inhibitors is universally accepted by locomotive builders.

Sodium chromate stops corrosion before it starts. The presence of this one chemical renders the metal surface passive to corrosive attack. Slight oxidizing action occurring upon initial contact produces an additional safeguard—a protective surface-deposit of iron and chromium oxides.

Diesel locomotives require only 2000 to 2500 ppm sodium chromate at pH 8.5 to 9.5 to minimize the combined

effects of vibration and corrosion. Other units such as standby boilers, stationary and marine diesels, hot water heating systems, and automobile radiators vary in their anti-corrosive requirements from 200 to 5000 ppm sodium chromate. It is important that sufficient chromate concentration be maintained at all times, for to leave valuable equipment unprotected even for short periods may result in serious damage.

Mutual, the world's largest manufacturer of chromium chemicals, supplies the chromates necessary for cooling system protection. Information about corrosion prevention in all types of cooling systems will be sent upon request.



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CHROMIC ACID

SODIUM BICHROMATE
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Branches: Corpus Christi, Dallas, Lubbock, Wichita Falls, McAllen (San Juan), Odessa.



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for cleaner
Over-all combustion



LUBAID-D is a diesel fuel additive that aids in achieving better, lower-cost performance, with shorter outages. LUBAID-D aids in dispersing gum, sludge and varnish. Aids in achieving free pumping. Aids in maintaining maximum compression pressures. Aids in achieving cleaner combustion, and reduction of port clogging and sticking valves.

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NOTE: Check our repair service on series No. 110 injectors, fuel transfer pumps and blowers.
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Attractive Distributor and Dealer
Propositions Left in a Few Areas—Write
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"America's Finest Diesel Component Rebuilders"

Shown at Cleveland Coal Show

The exhibit of the Detroit Diesel Engine Division of General Motors at the American Mining Congress Coal Show to be held in Cleveland May 11 to 14 will include three diesel engines of the "71" Series and one 6-110 model. All units will be equipped with General Motors torque converters.

A motorized cutaway model showing the operation of the Series 71 two-cycle diesel engine will also be on display. In the "71" Series three- and six-cylinder models widely used in loaders, power shovels, yard locomotives and heavy hauling equipment will be shown. The 6-110 model is the Division's highest horsepower single engine unit. The display will be assembled in booths 1628 and 1634 where factory and field personnel will be in attendance at all times.

Portable Automatic Engine for Oil Pumping

Designed for the oil pumping industry is the slow-medium speed heavy-duty Enterprise engine. This completely portable (skid mounted) automatic pipe line pumping rig will be shown at the International Petroleum Exposition in Tulsa, May 14 to 23. This unit will operate on a dual fuel principle. The Enterprise four-stroke cycle engine develops 400 bhp. at 800 rpm. The unit will drive, through Falk gears, a 6 in. two-stage United Centrifugal Pump rotating at 3550 rpm. and delivering 1510 gpm. at 375 psi. A Young radiator with engine-driven fan will provide jacket water cooling and hub oil cooling for the engine and gear. A fuel tank mounted under the radiator provides for eight hours of diesel operation at full load.

Automatic controls and normal shutdown controls are pneumatic with air supplied from the engine compressor or from the station supply. The unit is controlled by Foxboro pneumatic controllers which automatically shut down, restart, or alter speed to conform to predetermined suction or discharge pressures. First of the completely automatic portable pumping rigs of heavy duty type, the new Enterprise pumping unit fills a need in the industry for dependable, continuous, automatic pumping requirements.

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Can be furnished as illustrated,
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DIESEL PROGRESS

Fairbanks-Morse Annual Meeting

At the annual meeting of the shareholders of Fairbanks, Morse & Co., held recently J. A. Cuneo, general sales manager of the company, was elected to the Board of Directors. At the subsequent meeting the Board of Directors, Orren S. Leslie was elected vice president in charge of manufacturing, and G. J. Malone, formerly controller, was elected vice president-controller. Mr. Leslie joined the Fairbanks-Morse Company in 1951 as works manager of the Beloit, Wisconsin, plant. A year later he was appointed manager of manufacturing. Mr. Malone has been with the company many years and has progressed from the ranks to his present position. J. A. Cuneo has been with the Fair-

banks-Morse organization since 1929. Starting as a foreign traveling representative, he held many positions successfully. In 1947 he was appointed manager of the company's Los Angeles branch, and in 1949 he became manager of their Chicago branch. For the past two years he has been general sales manager.

Colonel Robert H. Morse, chairman, reported to the shareholders that the company's business is approximately 20 percent ahead of that for the same period of 1952. "How long this condition will last is something that cannot be predicted," said Colonel Morse, "but we do feel that the future is good. Our personnel and labor relations are quite satisfactory, and the recent work stoppage at our

Pomona, California, plant has now been settled to the satisfaction of both the employees and the Company."

The complete list of officers for the Company for 1953 were elected as follows: Col. Robert H. Morse, chairman and general manager; Robert H. Morse, Jr., president; Robert D. Craig, assistant to the president; F. J. Heaslip, vice president—Purchases and Traffic; O. S. Leslie, vice president—Manufacturing; G. J. Malone, vice president—Controller; V. H. Peterson, vice president—Railroad Sales; L. W. Stolte, vice president-treasurer; A. L. Stoddard, secretary; J. A. Cuneo, general sales manager; L. R. Gaiennie, director of personnel; E. T. Sandeen, assistant secretary.

Comparison Operating Data—Certain REA-Financed Internal Combustion Generating Plants January 1953

Plant No.	Size kw.	Gross Generation M KWH	Sta. Ser. %	Plant Factor %	R P C Factor %	Fuel-Cost Oil \$/gal.	Fuel-Cost Gas \$/MCF	BTU per KWH	HP/Hrs. per Gal. Lube	Man-hrs. Oper. Labor	Maint. Mat. \$	Production Costs			BEST OF THE MONTH		
												Mills/Net KWH	Fuel	Others			
7B.	4600	1,115.0	3.2	32.6	70.5	11.10	-----	9589	8712	1008	25	30.25	1.36	7.96	.47	9.79	9589
11.	3755	959.0	5.0	34.3	65.8	10.40	-----	9724	7547	920	96	912.88	2.52	7.34	1.29	10.95	9724
12.	4320	2,202.0	2.4	68.5	79.3	10.45	14.98	9771	9178	945	247	166.18	1.29	2.19	.59	4.07	9771
19C.	10,065	2,952.8	3.0	39.4	69.7	9.73	46.50	9414	2302	1069	264	334.98	.90	.65	4.84	6.39	9414
23.	6,525	1,489.0	4.0	30.7	63.4	10.15	-----	9654	13,059	1446	6	-----	1.70	7.05	.43	9.18	9654

February 1953

7B.	4,600	948.0	3.3	30.7	73.3	11.10	-----	9606	24,161	857	15	107.49	1.26	7.99	.34	9.59	9606
12.	4,320	2,181.0	2.3	68.0	78.7	11.96	15.12	9721	9368	1248	270	535.57	1.16	2.38	.56	4.10	9721
20.	3,939	776.0	2.5	29.3	49.3	10.39	-----	9656	38,212	331	54	226.40	1.03	6.38	.69	8.10	9656
23.	6,525	1,925.2	4.2	30.2	61.2	10.29	-----	9734	9837	1088	33	-----	1.69	7.22	.39	9.30	9734
25.	9,404	2,979.0	4.1	47.1	79.8	10.31	24.00	9674	4140	1888	271	454.98	1.20	2.89	.47	4.56	9674

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Write for Price List on Reclaimed GMC Injector Tips, Crown Check Valves and Check Valve Seats.

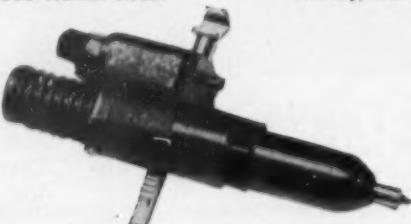
HANCOCK reconditioned unit injectors for GM 71 engines are available in 60mm, 70mm, 80mm and 90mm by mail. (Worn unit must be forwarded for each reconditioned unit ordered.)

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Special Representative



Stanley Wright

Stanley Wright, long-time diesel engineer, has been appointed special representative for Hamilton and Baldwin diesel engines in stationary power and marine applications in the New York area, it is announced by Baldwin-Lima-Hamilton Corporation. His office remains at 50 Church

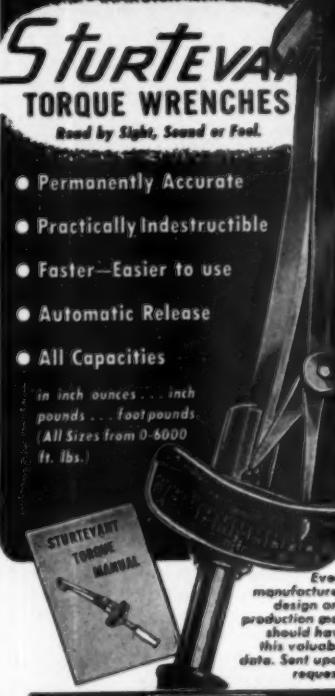
Street. Mr. Wright became interested in diesels soon after getting his M.E. from Cornell in 1912. His entire career has been devoted to diesel engineering and sales including considerable attention to marine problems. His work was largely with Busch-Sulzer until entering the WPB shipbuilding program in Washington during the war. He is a member of the American Society of Mechanical Engineering, an Affiliate of the Society of Naval Architects and Marine Engineers, and holds a professional engineer's license in New Jersey, his home state.

Executive Reorganization at Borg-Warner

A major reorganization of the top executive staff of Borg-Warner Corporation has been announced with the naming of three new vice-presidents. L. G. Porter is now administrative vice-president. He was formerly treasurer. R. S. Ingersoll was also elevated to an administrative vice-presidency. He was formerly president of the Ingersoll Products Division. Robert W. Murphy was elected vice-president and general counsel. He will continue to also head the legal department of Borg-Warner.

In announcing the appointments, Roy C. Ingersoll, president of Borg-Warner, said, "The need for additional operational executives has been dictated by the over-all growth of Borg-Warner and by the increasing diversification of the products we make."

SALES MANAGER wanted by one of the strong, active engine dealers in Southern California. Send full details past experience, etc. in first letter. Must have had some experience in retail selling of diesel and gasoline engines. Address: Box 510, DIESEL PROGRESS, 816 N. La Cienega Blvd., Los Angeles 46, Calif.



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"UNIFLO'S" unique design and construction result in lightweight, compact and adaptable unit.

"UNIFLO" is flexible. Either vertical or horizontal—can be supplied with "offset", "tangential" or "horizontal" inlets and outlets to suit any arrangement of piping. Meets U. S. Military Specifications.

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LARGEST CRANKSHAFT GRINDER IN A JOBBING SHOP

West Coast Diesel News

By FRED M. BURT

FROM Shepherd Marine to re-power Buster Hyders' Sport Fisher, San Pedro, a 6-cyl. 170-hp. Caterpillar diesel driving through new 3:1 Snow-Nabstedt reverse and reduction gear.

TO REPLACE a gasoline engine in a $\frac{1}{4}$ yd. Koehring shovel owned by White Limerock Co., Victorville, Calif. a new 3-cyl. 60-hp. P & H diesel engine from Engine Sales & Service, Los Angeles.

TO PROVIDE standby power for heat-treating furnaces at Norris-Thermador ordnance plant, Riverbank, Calif., two diesel electric sets from Salyers Equip Co., Los Angeles—200-hp. Buda natural gas engines, converted to use propane gas, with 100-kw. Delco generators.

A 100-KW. diesel electric set, with 165-hp. Murphy engine purchased by Kelly Yont, El Cajon, Calif., powers a rock crusher at his lime mill.

TO POWER pump for sprinkler irrigation system for F. R. Fricke, Chino, Calif., a 52-hp. Caterpillar diesel from Shepherd Tractor & Equip. Co., Los Angeles.

THOMAS PRINCE, proprietor of *The Thing*, a resort near Bakersfield, has purchased a 10-kw. generating set for lights, powered with a 1-cyl., 12-hp. horizontal, water-cooled Witte diesel replacing a gasoline engine powered set.

SUPPLIED BY Wagner Pump & Equip. Co., Santa Ana, to Eucalyptus Water Co., Anaheim, a 6-cyl. 100-hp. Buda natural gas engine to power a deep-well turbine pump supplying irrigation water.

ANDERSON-O'BRIEN CO., Los Angeles, report March sales of 11 General Motors diesel engines

ranging from 2-cyl., 46-hp. to twin-six 300-hp. units, for diversified usages—irrigation, powering contractor's equipment, oil drilling, well servicing, rig lighting, etc.

FOR THE U. S. Navy at Seal Beach, Fallbrook, and Inyokern (Calif.) stations, ten Bay City cranes powered with Cummins diesels, 110-hp. to 175-hp.

A 60-HP. Caterpillar diesel with 2:1 Twin Disc gear installed by Joe Castagnola, Santa Barbara, in tow boat used in handling flexible hose for loading off-shore tankers at Tide Water Associated Oil Co. station at Toledo, Calif.

USED BY C. F. Braun Co. of Alhambra, in construction of synthetic ammonia plant for Brea Chemical Co. (Union Oil Co. subsidiary) near Brea, Calif., 12 Cooper-Bessemer compressors ranging from 1000 to 2250-hp.

FOR STANDBY power at Georgia Air Force Base, Victorville, Calif., a 225-hp. Cummins diesel electric set with Electric Machinery generator.

ADDED TO the Santa Fe Transportation truck fleet in Los Angeles, seven International COE units powered with 200-hp. Cummins diesels.

FOR NAVY'S missile launching test station at Point Mugu, Calif. to provide standby power, a 200-kw. diesel-electric set; twin-six, 300-hp. General Motors engines, Delco generator.

A 320-HP. NATURAL gas engine driven Cooper-Bessemer compressor, skid-mounted, for Ohio Oil Co. will be used in gas handling operations in the Bakersfield area.

SOLD through Bellingham Engine & Equip. Co., two 230-hp. GM diesels to power 100-kw. dc. generators for electric drive in yard locomotive of Olympic Cement Co., Bellingham, Wash.

SOLATONE

ANTI-CARBON

FOR ALL FUELS AND LUBES
WITH OR WITHOUT SOLVENT



EASY TO INSTALL

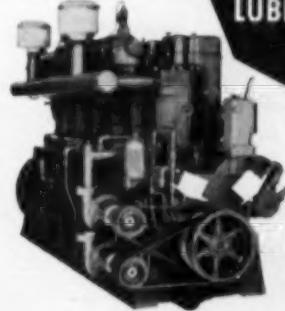
Is a catalytic apparatus which removes and prevents formation of gum and abrasive carbon deposits. Exhaustive tests on engines under no-load, partial-load and full-load conditions have proven that SOLATONE will more than pay its way with greater engine efficiency and reduced maintenance costs.

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For dependable lubrication of diesel engines and power units, Tuthill offers a complete line of positive displacement pumps, designed for lubricating and scavenging. Included are automatic reversing pumps and stripped models for built-in applications.

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Canadian Affiliate: Ingersoll Machine & Tool
Company, Ltd., Ingersoll, Ontario, Canada

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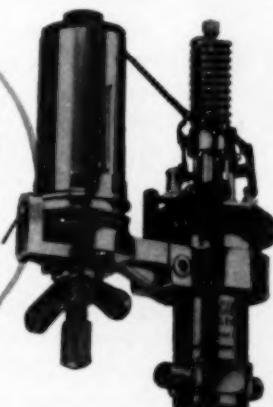


Complete facilities for grinding, plating, Magnafluxing, and electrically-controlled heat-treating. Largest hard-chrome plating plant in Mid-Continent area. **Experience • Quality • Precision**

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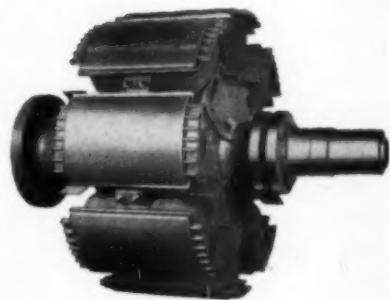
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Full details on Elliott Synchronous Generators (High-Speed) in Bulletin PB2400-1. On request.

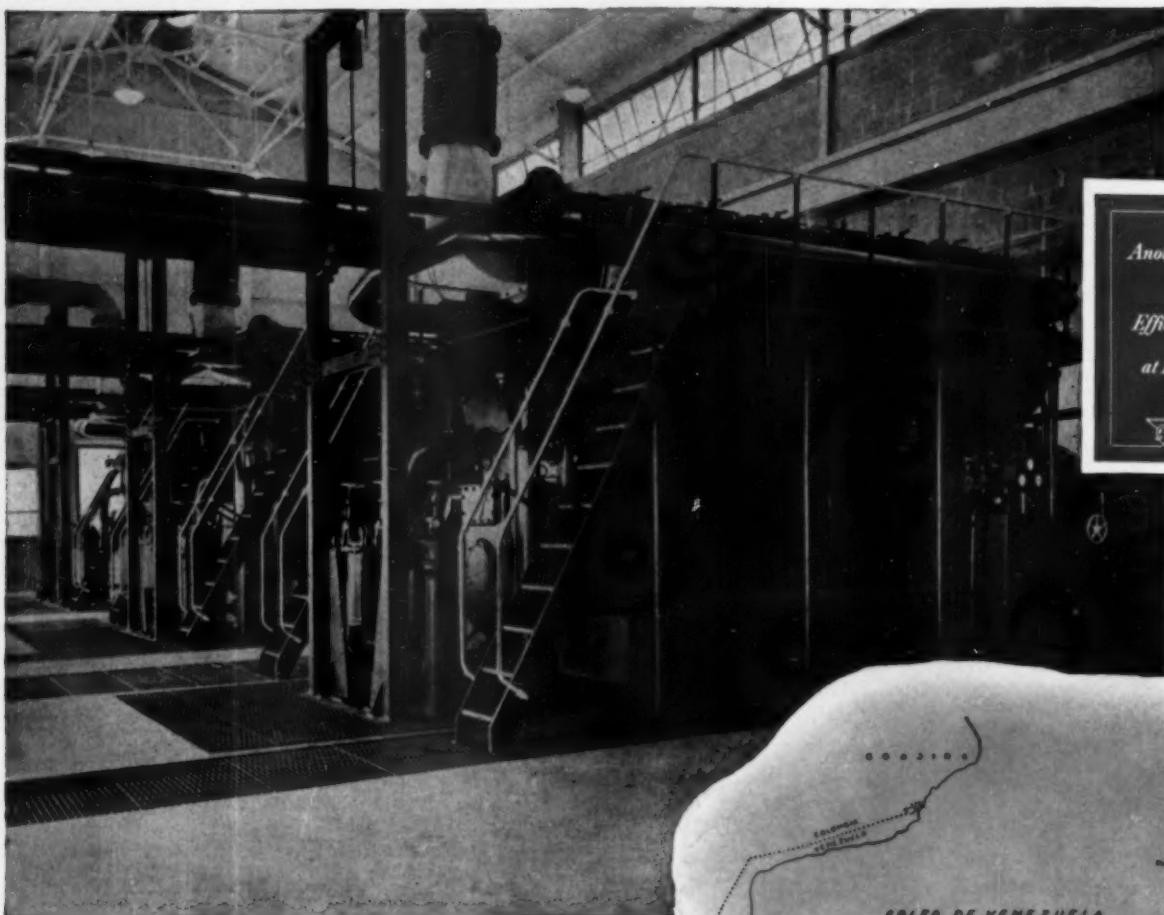
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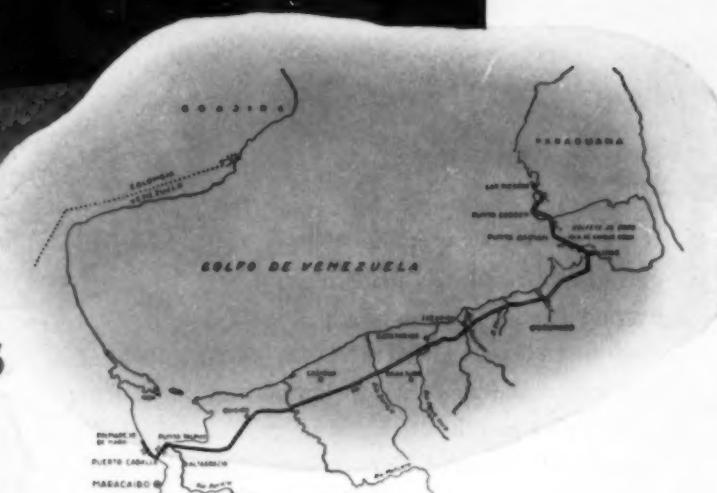




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